

BUILDING A 100 PERCENT CLEAN ECONOMY: SOLUTIONS FOR THE U.S. BUILDING SECTOR

HEARING BEFORE THE SUBCOMMITTEE ON ENERGY OF THE COMMITTEE ON ENERGY AND COMMERCE HOUSE OF REPRESENTATIVES ONE HUNDRED SIXTEENTH CONGRESS FIRST SESSION

SEPTEMBER 20, 2019

Serial No. 116-64



Printed for the use of the Committee on Energy and Commerce
govinfo.gov/committee/house-energy
energycommerce.house.gov

U.S. GOVERNMENT PUBLISHING OFFICE

42-621 PDF

WASHINGTON : 2021

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BUILDING A 100 PERCENT CLEAN ECONOMY: SOLUTIONS FOR THE U.S. BUILDING SECTOR

FRIDAY, SEPTEMBER 20, 2019

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY,
COMMITTEE ON ENERGY AND COMMERCE,
Washington, DC.

The subcommittee met, pursuant to call, at 9:00 a.m., in the John D. Dingell Room 2123, Rayburn House Office Building, Hon. Bobby L. Rush (chairman of the subcommittee) presiding.

Members present: Representatives Rush, Peters, McNerney, Tonko, Loeb sack, Butterfield, Welch, Schrader, Kennedy, Veasey, Kuster, Kelly, Barragán, O'Halleran, Blunt Rochester, Pallone (ex officio), Upton (subcommittee ranking member), Latta, Rodgers, McKinley, Griffith, Johnson, Bucshon, Flores, Walberg, Duncan, and Walden (ex officio).

Staff present: Jeffrey C. Carroll, Staff Director; Jean Fruci, Energy and Environment Policy Advisor; Catherine Giljohann, FERC Detailee; Waverly Gordon, Deputy Chief Counsel; Tiffany Guarascio, Deputy Staff Director; Omar Guzman-Toro, Policy Analyst; Zach Kahan, Outreach and Member Service Coordinator; Rick Kessler, Senior Advisor and Staff Director, Energy and Environment; Brendan Larkin, Policy Coordinator; Dustin J. Maghamfar, Air and Climate Counsel; John Marshall, Policy Coordinator; Elysa Montfort, Press Secretary; Meghan Mullon, Staff Assistant; Joe Orlando, Staff Assistant; Alivia Roberts, Press Assistant; Tim Robinson, Chief Counsel; Rebecca Tomilchik, Staff Assistant; Tuley Wright, Energy and Environment Policy Advisor; Peter Kielty, Minority General Counsel; Mary Martin, Minority Chief Counsel, Energy, and Environment and Climate Change; Brandon Mooney, Minority Deputy Chief Counsel, Energy; Brannon Rains, Minority Legislative Clerk; and Peter Spencer, Minority Senior Professional Staff Member, Environment and Climate Change.

Mr. RUSH. The Subcommittee on Energy will now come to order.

The Chair now recognizes himself for 5 minutes for the purposes of an opening statement.

OPENING STATEMENT OF HON. BOBBY L. RUSH, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

I want to thank you all for joining us this morning for this important hearing entitled "Building a 100 Percent Clean Energy Economy: Solutions for the U.S. Building Sector."

This hearing is part of a series that we will be holding in this subcommittee and in other subcommittees to highlight areas where

we can achieve significant emissions reductions in order to achieve a 100 percent clean energy economy by 2050, as Chairman Tonko and I proposed back in July.

As we know, the building sector is responsible for an estimated 40 percent of energy consumed and greenhouse gas emissions that are produced nationwide. In the same time, there are numerous opportunities for reducing these emissions through technology advances, efficiency sufficient standards, and innovative programs such as Energy Star, Smart Metering, and others that are on the drawing boards.

Additionally, there are tremendous employment opportunities for putting Americans to work in my district and in every district in our Nation. These are good-paying, quality retrofitting jobs that can not be exported. In fact, earlier this week, E4TheFuture released its 2019 energy efficiency jobs in America report which show that the energy efficiency sector added more jobs than any other energy sector for the second straight year. The study noted that there are over 2.3 million Americans currently employed in energy efficiency sector including more than 89,000 jobs in the State of Illinois and over 5,000 jobs in my district on the South Side of Chicago.

While it is important for Congress to provide resources and establish policies to guide actions in these areas of energy efficiency, as my bill, H.R. 1315, the Blue to Green Collar Job bill does. It is also critical that the Federal Government sets the example through its action. You can't lead where you don't go.

There are literally thousands of federally owned office buildings, courthouses, post offices, and the likes that must be retrofitted in order to save millions, if not billions, of dollars annually in energy savings. My staff is working on legislation that would ensure that the Federal Energy Management Program, or FEMP, must ensure that minority business owners and entrepreneurs are able to participate in this multibillion-dollar, tax-funded program.

It is way past the time for the Department of Energy to work within these contracts so that these good old boys networks are not the only entities receiving these lucrative, government-backed contracts.

Tackling this issue are making our homes, our schools, and our business more energy efficient, will save money, put people back to work, and expand the American middle class. It will help us to address the severe issue of climate change also.

So I welcome each of these distinguished panelists to today's hearing. I look forward to engaging them on the best ways to an achieve each of these objectives.

It is now my distinct honor, privilege to welcome my friend and my colleague from the great Midwestern State of Michigan, the ranking member, Fred Upton, for his opening statement.

[The prepared statement of Mr. Rush follows:]

PREPARED STATEMENT OF HON. BOBBY L. RUSH

I want to thank you all for joining us this morning for this important hearing entitled: Building a 100 Percent Clean Economy: Solutions for the U.S. Building Sector.

This hearing is part of a series that we will be holding in this subcommittee and others to highlight areas where we can achieve significant emissions reductions in order to realize a 100 percent clean energy economy by 2050 as Chairman Pallone, Chairman Tonko, and I proposed back in July.

As we know, the building sector is responsible for an estimated 40 percent of energy consumed and greenhouse gas emissions produced nationwide.

Yet, there are enormous opportunities for reducing these emissions through technological advances, efficiency initiatives, and innovative programs, such as Energy Star, smart metering, and others.

Additionally, there are tremendous employment opportunities for putting people to work, in my district and in communities nationwide, in good paying, quality retrofitting jobs that cannot be exported.

In fact, earlier this week E4TheFuture released its 2019 Energy Efficiency Jobs in America report which showed that the energy efficiency sector added more jobs than any other energy sector—for the second straight year, I might add.

The study noted that there are over 2.3 million Americans currently employed in the energy efficiency sector, including more than 89,000 jobs in the State of Illinois, and over 5,000 employed in my district on the Southside of Chicago.

While it is important for Congress to provide resources and establish policies to guide action in the area of efficiency initiatives, as my Blue Collar and Green Collar Jobs bill does, it is also critical that the Federal Government sets the example through its actions.

There are literally thousands of federally owned office buildings, courthouses, post offices and the like that must be retrofitted in order to save millions, if not billions, of dollars in energy savings.

My staff is working on legislation that would make certain that the Federal Energy Management Program, or FEMP, would ensure that minority business owners and entrepreneurs are able to participate in this multibillion-dollar, taxpayer-funded program.

It is past time for the Department of Energy to open up these contracts so that the same participants of the “good old boys” networks are not the only entities receiving these lucrative, government-backed deals.

Tackling this issue of making our homes, schools, and businesses more energy efficient will save money, put people back to work, and help us to address the severe issue of climate change.

So I welcome each of our distinguished panelists to today’s hearing and I look forward to engaging them on the best ways to achieve each of these objectives.

I would now like to welcome my friend and colleague from the great State of Michigan, Ranking Member Upton, for his opening statement.

OPENING STATEMENT OF HON. FRED UPTON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MICHIGAN

Mr. UPTON. Well, thank you, Mr. Chairman. We are close friends for sure. But I also want to thank our witnesses for appearing before us today.

But before we begin, I just want to call our attention to a legislative matter that does require the full committee’s attention.

As you know, the Pipeline Safety Act is about to expire in another week and a half, and we should remind everyone that this is a reauthorization bill that we have consistently passed with unanimous consent under Republican majorities. I am troubled that we are not yet at a point where we can say that we have a bipartisan agreement to move forward to full committee. We owe it to our constituents to do better. So I would hope that we could work together on this bill in the short couple days ahead.

Turning to the subject at hand, I want to use today’s hearing to focus on real-world solutions to improve the performance and environmental sustainability of our homes and our commercial buildings. Thanks to innovation and technological advancements, we are making great strides to reduce energy consumption and enhance building performance, but we still have room for improvement.

So as we consider clean energy solutions for the building sector at the Federal level, we have to recognize that these high performance, or green technologies, are often more expensive to design, build, and maintain. And as policymakers, we need to take this into account, especially as we are confronted with declining rates of home ownership, increasing rental prices and high vacancy rates in any many Americans.

I believe that cleaner solutions for the building sector must meet three core objectives. They have to be affordable, cost effective, and they must be driven by consumer demand rather than government mandates. Housing affordability is my number one concern. It has been reported that housing affordability is near a 10-year low, and public polling confirms 80 percent of Americans think housing affordability is, in fact, in a crisis.

With a large and growing share of American households having difficulty finding housing that they can afford, this committee should be focused on ways to make housing less expensive rather than piling on more rags and driving up the cost.

I am also concerned about the cost effectiveness of some of the proposals such as those with net-zero or carbon-free mandates. We need to be honest about the performance tradeoffs, the higher up-front cost, and number of years it will take to pay back the difference. We have to look at the life cycle of the products and the building itself before jumping to a "one size fits all" regulation that does, in fact, pick technology winners and losers.

Finally, I just believe that clean building solutions must be consumer driven in order to be successful. Consumers know what they want, they know what they don't like. And they question about government telling them what they can and cannot have. Americans demand high performance, cost effectiveness, and, most importantly, plenty of options to choose what works best for them. Experience has shown that consumers are turned off by expensive mandates, but they are more open to properly placed incentives.

And as you think about clean solutions for the building sector, I would challenge everyone to think about clean building solutions that really do add value to their homes.

With that, I look forward to the hearing. I also want to have a special welcome to Arn McIntyre, who has traveled from, yes, the great State of Michigan to be with us today. He has got a great perspective. He is a custom home builder, a leader in energy efficiency and environmentally friendly design, State of Michigan building inspector, and he provides research and consulting business in the building sector as a whole.

And with that, Mr. Chairman, I yield back.

[The prepared statement of Mr. Upton follows:]

PREPARED STATEMENT OF HON. FRED UPTON

Thank you, Mr. Chairman, and to our witnesses for appearing before us today. Before we begin, I would like to call attention to a legislative matter that requires this committee's attention. Mr. Chairman, as you know, the Pipeline Safety Act is about to expire at the end of this month. We should remind everyone that this is a reauthorization bill that we have consistently passed with unanimous consent under Republican majorities. However, I am troubled by what appears to be a lack of willingness to work on a bipartisan basis this time around. We owe it to our constituents to do better, which is why Republicans are asking you to please, come back

to the table and work with us so we can get this bill in shape for a full committee markup.

Now, turning to the subject at hand. I would like to use today's hearing to focus on real world solutions to improve the performance and environmental sustainability of our homes and commercial buildings. Thanks to innovation and technological advancements, we are making great strides to reduce energy consumption and enhance building performance—but we still have room for improvement.

As we consider clean energy solutions for the building sector at the Federal level, we must recognize that these high-performance, or “green” technologies are often much more expensive to design, build, and maintain. As policymakers, we need to take this into account, especially as we are confronted with declining rates of homeownership, increasing rental prices, and high vacancy rates in many American cities.

I firmly believe that cleaner solutions for the building sector must meet three core objectives. They must be affordable, they must be cost effective, and they must be driven by consumer demand, rather than government mandates.

Housing affordability is my number one concern. It has been reported that housing affordability is near a 10-year low and public polling confirms 80 percent of Americans think housing affordability is in a crisis. With a large and growing share of American households having difficulty finding housing they can afford, this committee should be focused on ways to make housing less expensive, rather than piling on more regulations and driving up costs.

I am also concerned about the cost-effectiveness of some of the proposals, such as those with “net zero” or “carbon free” mandates. We must be honest about the performance trade-offs, the higher upfront costs, and the number of years it will take to payback the difference. We must also look at the lifecycle of the product and the building itself before jumping to a one-sized-fits-all regulation that picks technology winners and losers.

Finally, I believe that clean building solutions must be consumer-driven in order to be successful. Consumers know what they want, and they do not like the Government telling them what they can and cannot have. Americans demand high performance, cost-effectiveness, and most importantly, plenty of options to choose what works best for them. Experience has shown that consumers are turned off by expensive mandates, but they are more open to properly placed incentives. As we think about clean solutions for the building sector, I would challenge everyone to think about clean building solutions that truly add value to homes.

With that, I look forward to hearing from the witnesses to learn more about the types of clean building solutions that consumers are excited to purchase. I would also like to offer a special welcome to Arn McIntyre who traveled from the great State of Michigan to be with us today. Mr. McIntyre has a very interesting perspective: he is a custom homebuilder, a leader in energy-efficient and environmentally friendly design, a State of Michigan building inspector, and he provides research and consulting to the building industry as a whole.

As I mentioned in the beginning, I plan to spend today's hearing focusing on affordability, cost-effectiveness, and consumers. I look forward to a constructive conversation, and at this time, I yield back the balance of my time.

Mr. RUSH. The gentleman yields back. The Chair now recognizes the esteemed chairman of the full committee, my friend from the great State of New Jersey, Mr. Pallone, for 5 minutes for the purposes of an opening statement.

OPENING STATEMENT OF HON. FRANK PALLONE, JR., A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW JERSEY

Mr. PALLONE. Thank you, Chairman Rush.

Today's hearing is the committee's second this week and third in a series of ongoing hearings as we work to achieve 100 percent clean economy by 2050.

On Wednesday, the Environment and Climate Change Subcommittee examined the challenges in the industrial sector, and today this subcommittee will review the U.S. building sector. We will discuss policies to reduce pollution and save money by making our buildings more efficient.

Residential and commercial buildings are responsible for nearly 40 percent of U.S. carbon pollution, more than any other sector. And this is not only attributable to electricity consumption but also to the use of fossil fuels and furnaces, hot water heaters, and other building equipment and appliances. Roughly half of building floor space in U.S. is heated by fossil fueled fired systems.

In developing a 100 percent clean economy by 2050 is not going to be easy, but it is absolutely necessary. And there are policies and solutions in the building sector that can help us reach that goal. Reducing pollution from buildings is tied to the power sector in how we produce electricity. Buildings account for 70 percent of U.S. electricity consumption, and that means making them 100 percent clean, requires transitioning the power sector to clean, no carbon resources, like renewables and nuclear power.

And perhaps the quickest and easiest way to reduce building emissions is by improving building efficiency. Existing energy efficiency measures have shown the ability dramatically reduced building energy use and the associated operating cost for heating, cooling, and lighting. Yet there is much more we can do accelerate and broaden the adoption of these technologies: Adhering to strong building energy codes, updating Federal minimum energy efficiency standards for building equipment and appliances, and bolstering Federal support for programs to weatherize homes can all make a huge impact.

Unfortunately, President Trump is stifling this effort to both save money and reduce carbon pollution. His administration has refused to finalized or update efficiency standards for more than a dozen consumer products. At the same time, he is rolling back efficiency standards for light bulbs, allowing inefficient products to stay on the market for years. And this wastes energy and costs consumers more money.

And as we explore ways to reduce carbon pollution from the building sector, we have to improve the energy performance of existing buildings that will likely still be in use in 2050.

So the upfront costs of retrofitting remain a barrier we must address. This committee has already taken—already acted by passing a bill authored by Chairman Tonko and Rush to increase funding for DOE’s weatherization assistance program. We passed legislation by Representative Kelly to provide funds for public building efficiency upgrades, and we passed Representative’s Stanton and Veasey’s bill to reauthorize the energy efficiency and conservation block grant program. And these are all going to help, but we still need to do a lot more to meet the 2050 goal.

There are several interesting ideas that I look forward to exploring today, including performance standards for existing buildings, innovative smart building controls, use of net zero building materials and designs, and electrification of heating and cooling systems.

States have often been leaders on this issue. My home State of New Jersey has a draft energy master plan that calls for the electrifying the building sector by 2050 and reducing the reliance on natural gas for heating homes and buildings. And other States are making similar progress. But the Federal Government must also lead efforts to decarbonize commercial and residential buildings

across the country. Making existing buildings more energy efficient can create jobs in every community around the country. Over 2 million Americans work in energy efficiency, and it is the fastest growing energy sector in the whole country.

So the widespread need for this work also creates opportunities to invest in worker training and address local unemployment in vulnerable communities. Increasing Federal investment in energy efficiency will spur job growth in community development that will impact every State and district. And reducing building emissions will help us address the climate crisis, obviously. It will also lower energy bills and make the buildings we live and work in more comfortable, safer, and healthier.

So I look forward to the testimony from our panel of witnesses today as we look to find solutions that will work for all of us.

And with that, Mr. Chairman, unless somebody else wants—there is not much time back.

I yield back.

[The prepared statement of Mr. Pallone follows:]

PREPARED STATEMENT OF HON. FRANK PALLONE, JR.

Today's hearing is the committee's second this week and third in a series of ongoing hearings as we work to achieve a 100 percent clean economy by 2050. On Wednesday, the Environment and Climate Change Subcommittee examined the challenges in the industrial sector, and today this subcommittee will review the U.S. building sector. We will discuss policies to reduce pollution and save money by making our buildings more efficient.

Residential and commercial buildings are responsible for nearly 40 percent of U.S. carbon pollution—more than any other sector. This is not only attributable to electricity consumption, but also to the use of fossil fuels in furnaces, hot water heaters and other building equipment and appliances. Roughly half of building floor space in the U.S. is heated by fossil fuel-fired systems.

Developing a 100 percent clean economy by 2050 is not going to be easy, but it is absolutely necessary and there are policies and solutions in the building sector that can help us reach that goal.

Reducing pollution from buildings is tied to the power sector and how we produce electricity. Buildings account for 70 percent of U.S. electricity consumption, and that means making them 100 percent clean requires transitioning the power sector to clean, no-carbon resources, like renewables and nuclear power.

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Unfortunately, President Trump is stifling this effort to both save money and reduce carbon pollution. His administration has refused to finalize or update efficiency standards for more than a dozen consumer products. At the same time, he is rolling back efficiency standards for lightbulbs, allowing inefficient products to stay on the market for years. This wastes energy and costs consumers more money.

As we explore ways to reduce carbon pollution from the building sector we must: improve the energy performance of existing buildings that will likely still be in use in 2050.

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There are several interesting ideas that I look forward to exploring today, including performance standards for existing buildings, innovative smart building controls, the use of net-zero building materials and designs, and electrification of heating and cooling systems.

States have often been leaders on this issue. My State of New Jersey has a draft “Energy Master Plan” that calls for electrifying the building sector by 2050 and reducing the reliance on natural gas for heating homes and buildings. Other States are making similar progress. But the Federal Government must also lead similar efforts to decarbonize commercial and residential buildings across the country.

Making existing buildings more energy efficient can create jobs in every community across the country. Over 2 million Americans work in energy efficiency, and it is the fastest growing energy sector in the country. The widespread need for this work also creates opportunities to invest in worker training and address local unemployment in vulnerable communities. Increasing Federal investment in energy efficiency will spur job growth and community development that will impact every State and district.

Reducing building emissions will help us address the climate crisis. It will also lower energy bills and make the buildings we live and work in more comfortable, safer and healthier. I look forward to the testimony from our panel of witnesses today as we look to find solutions that will work for all of us.

Mr. RUSH. The Chair yields back.

Members, want to take just a moment for personal privilege before we entertain our—and listen to our witnesses.

Some 15 years ago, I hired a young man on my staff who has been very involved to me such a remarkable and effective, brilliant young man. And a few days ago, he informed me that he would be leaving my staff to go to the private sector.

And I must note, and this was a few weeks after he got married. So he married a wise woman. She made him leave in order to go make some more money. But notwithstanding that, I just really wish—this man has meant so much to me, and to each and every one of you, I hope. And on his last—this is his last hearing before, in this subcommittee. Would you please join me in giving John Marshall a big round of applause as—

[Applause.]

I would now like to welcome our witnesses for today’s hearing. Mr. Carl Elefante is the 2018 AIA president, and that is the American Institute of Architects. He is here. Welcome, Mr. Elefante.

Mr. Steven Nadel is the executive director of the American Council for Energy Efficiency Economy. Welcome, Mr. Nadel.

Dr. Curtis Zimmermann is the manager of—government liaison, rather, for BASF Corporation. Welcome, Mr. Zimmermann.

And now I would also take at a moment to especially welcome to this hearing and acknowledge someone from my home district in Chicago, Mr. Timothy Keane, who is the international vice president at large for the International Association of Heat and Frost Insulators and Allied Workers. Welcome, Mr. Keane, my friend.

Mr. Arn McIntyre, who is the president of McIntyre Builders, Inc., on behalf of the National Association of Home Builders.

And lastly Ms. Elizabeth Beardsley, who is the senior policy counsel for the U.S. Green Building Council.

I want to thank you all for joining us here today. And we look forward to your testimony.

Before we begin, a part of our ritual is that there is a lighting system before you. And the light will initially be green at the start of your opening statement. The light will turn yellow when you have 1 minute remaining. Please begin to wrap up your testimony

at that point. The light will turn red when your time is expired, and then a siren will go off if you don't adhere to that time.

Mr. Elefante, you are recognized for 5 minutes.

STATEMENTS OF CARL ELEFANTE, PAST PRESIDENT, AMERICAN INSTITUTE OF ARCHITECTS; STEVEN NADEL, EXECUTIVE DIRECTOR, AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY; CURTIS J. ZIMMERMANN, Ph.D., MANAGER, GOVERNMENT LIAISON, BASF CORPORATION; TIM KEANE, INTERNATIONAL VICE PRESIDENT AT LARGE, INTERNATIONAL ASSOCIATION OF HEAT AND FROST INSULATORS AND ALLIED WORKERS; ARN MCINTYRE, PRESIDENT, MCINTYRE BUILDERS, INC., ON BEHALF OF THE NATIONAL ASSOCIATION OF HOME BUILDERS; AND ELIZABETH R. BEARDSLEY, SENIOR POLICY COUNSEL, U.S. GREEN BUILDING COUNSEL

STATEMENT OF CARL ELEFANTE

Mr. ELEFANTE. Thank you, Mr. Chairman.

Good morning, Chairman Rush, Ranking Member Upton, and members of the subcommittee. My name is Carl Elefante, as you already know. I am the immediate past president of the American Institute of Architects, known as AIA.

Thank you for this opportunity to share what AIA and its more than 94,000 members are doing to make the Nation's buildings more energy efficient. For more than 160 years, the AIA's mission has remained constant: To advance our Nation's quality of life and to protect the public's health, safety, and welfare. AIA's founders helped lead the fight for the then-novel concept of fire codes. Today it is unimaginable that any building would be constructed without following them.

Right now we are at a similar inflection point when it comes to the built world: Specifically the necessary role of buildings to fight climate disruption. Buildings account for 75 percent of the electricity used in the United States and 28 percent of methane use.

Overall, buildings represent 39 percent of the Nation's primary energy use and greenhouse gas emissions. To reduce the impact of buildings on our environment and to make our communities healthy, secure, and resilient, AIA supports your goal of net zero emissions for the buildings by 2050.

To achieve your goal, we are focused on four imperatives. First, net-zero carbon building design; second, net-zero carbon renovation and retrofit; third, net-zero carbon construction and materials; and fourth renewable energy use in buildings.

Success of these initiatives will require a holistic integrated approach and long-term commitment to incorporate these strategies into the design, construction, operation, and maintenance of the Nation's buildings. Ultimately in the decades ahead, we want them to be as fundamental to the construction of buildings as fire and life safety codes are today.

Why? Because the threat posed by climate disruptions to our homes, cities, Nation, and planet require that we fundamentally re-examine how we develop and adapt the built world.

To cite one example and one that receives too little attention today, it is important to rapidly accelerate the retrofitting of existing buildings. It is estimated that in order to meet 2050 emissions targets, among other actions, 75 percent of the existing commercial and institutional building stock, 54 billion square feet—billion square feet—excuse me—needs to be renovated or retrofitted that is, on average, nearly 2 billion square feet per year.

For context, that is about four times current rates which, by the way, are at an all-time high. That is a prime example that highlights the magnitude of the challenge. But as architects, facing big challenges is our day job.

We know that appropriate standards of design and construction can be utilized to combat climate disruption. We also know that partnership with business, civic, and elected leaders is the surest path to success.

The Nation's architects, engineers, developers, building product manufacturers, and others have the technical expertise needed to contribute to the fight of climate disruption. However, we can do more in partnership with you and your colleagues at the Federal, State, and local levels who share your vision and our passion to transform the built environment.

Together we can make a difference. Together we can assure that buildings help achieve dramatic reductions in energy use and greenhouse gas emissions to fight climate disruption.

AIA looks forward to working with you, this subcommittee, and Congress to make our Nation's buildings part of the solution to climate disruption through the power of design.

Again, thank you to the subcommittee for this opportunity. I look forward to your questions and our discussion this morning.

[The prepared statement of Mr. Elefante follows:]



House Subcommittee on Energy

Hearing on Building Energy Efficiency

September 20, 2019

Testimony of the American Institute of Architects (AIA)

Good morning, Chairman Rush, Ranking Member Upton and Members of the Subcommittee. My name is Carl Elefante, the immediate past President of the American Institute of Architects (AIA). Thank you for the opportunity to share what the AIA and its more than 94,000 members are doing to make the nation's buildings more energy efficient.

For more than 160 years, AIA's mission has remained constant: To advance our nation's quality of life and protect the public's health, safety, and welfare. The architects of that generation helped lead the fight for the then novel concept of mandatory "fire codes."

Today, it is unimaginable that any building would be constructed without them. Right now, we are at a similar inflection point when it comes to the built world, specifically the necessary role of buildings to fight climate change.

Buildings, account for 75 percent of electricity use in the United States and 28 percent of natural gas use. Overall, buildings represent 39 percent of the nation's primary energy use and greenhouse gas emissions.

To reduce the impact of buildings on our environment, AIA supports your goal of net-zero emissions from buildings by 2050.

To achieve that goal, we are focused on four components:

1. Zero-net carbon building design;
2. Zero-net carbon renovation or retrofit;
3. Zero-net carbon construction and materials; and
4. Renewable energy use in buildings.

Success on these initiatives will require a holistic approach and long-term commitment from every aspect of our society to incorporate these principles into the design, construction, operation, and maintenance of the nation's buildings. Ultimately, in the decades ahead, we want them to be as fundamental to the construction of buildings as fire and public safety codes are today.

Why? Because the threat posed by climate change to our homes, cities, nation, and the planet require that we fundamentally reexamine how we develop and adapt the built world. To cite one example, and one that receives little consideration today, is the importance of rapidly accelerating the retrofitting of existing buildings.

Consider that, in order to meet 2050 emissions targets, 75 percent of the *existing* commercial and institutional building stock – 54 billion square feet – needs to be renovated and retrofitted. That’s, on average, nearly 2 billion square feet per year. For context, that is about four times the current rate, which, by the way, is at an all-time high.

That’s a prime example that highlights the magnitude of the challenge, but as architects, facing big challenges is our “day job.” We know that new standards of design and construction can be utilized to combat climate change. We also know that partnership with business, civic and elected leaders is the surest path to lasting success.

The nation’s architects, engineers, developers, building product manufacturers, and others have the technical expertise needed to help lead the fight against climate change. However, we could do more in partnership with you

and your colleagues at the federal, state, and local levels who share our vision and our passion to transform the built environment.

Together, we can make a difference. Together we can ensure that buildings help us to achieve dramatic reductions in energy use and greenhouse gas emissions to fight climate change.

AIA looks forward to working with members of this Subcommittee, Congress, and state and local leaders to make our nation's buildings part of the solution to climate change through the power of design.

Again, I thank the Subcommittee members for this opportunity to testify before you today, I look forward to our discussion, and welcome your questions.

Mr. RUSH. The Chair recognizes Mr. Steven Nadel, 5 minutes.

STATEMENT OF STEVEN NADEL

Mr. NADEL. OK. Thank you, Mr. Chairman, Ranking Member, other members of the committee. I appreciate the opportunity to testify here today.

My organization, the American Council for an Energy-Efficient Economy, otherwise known as ACEEE, was founded in 1980 by researchers at universities and National Laboratories. We produce more than 30 reports and other research products each year on energy saving technologies, programs, and policies.

Earlier this week, ACEEE released a major report entitled Halfway There: Energy Efficiency Can Cut Energy Use and Greenhouse Gas Emissions in half by 2050. This report shows how energy efficiency can make a large contribution toward reaching long-term climate goals while also saving consumers and businesses money, providing jobs, improving comfort, and reducing the health impacts associated with indoor air pollution.

Specifically, our analysis included 11 different efficiency opportunities which five address the building sector. Improved appliances and equipment, zero-energy new buildings, smart buildings, building retrofits, and electrifying existing buildings.

Overall, we estimate that the 11 opportunities can reduce 2050 U.S. energy use by about 50 percent, cut it in half, and also reduce carbon dioxide emissions, in this case by 57 percent, in total reducing greenhouse gases by about 50 percent once we include the non CO2 greenhouse gases.

The building sector accounts for nearly 40 percent of U.S. energy use in emissions. We found from our five buildings measures that 2050 building sector energy use could be reduced by a little over 50 percent. No single measure dominates the savings. The overall savings require the combined effect of many different measures as shown in Figure 1 in my written testimony. And we are going to try to show it on the screen, but I guess that didn't work. So we will—very good. Thanks.

[Slide shown.]

In addition, we conducted a policy analysis looking at policies to implement each of the efficiency opportunities we analyzed. Our policy analysis found a path for achieving about 90 percent of the efficiency opportunity we identified. A little bit more than 90 percent for commercial buildings; a little bit less for homes because of the difficulty convincing people to retrofit their homes. The allocation of savings by policy is shown in Figure 2 of my written testimony, which I believe—yes, thank you very much, which shows up there.

[Slide shown.]

Let me talk now a little bit more about some of the policies, starting with new construction. As the law of whole states, when you are in a hole, the first thing to do is stop digging. In order to address climate change, one of the first priorities is to stop building inefficient homes and buildings and instead build them as efficiently as possible.

While substantial progress has been made, multiple organizations are all targeting adoption of codes by 2030 that will move to-

wards zero-energy—or zero-carbon new homes and buildings when the energy use is summed over the course of an entire year.

Such buildings typically combine high levels of energy efficiency, reduce loads about 70 percent below typical new buildings, with on-site renewable energy systems to provide the remaining energy. And where there it is not sufficient on-site renewable energy, off-site renewable energy can be used.

In order to encourage movement towards these types of buildings, we recommend a variety of steps. First, adopt H.R. 3962 introduced by Representatives McKinley and Welch. This includes provisions promoting regular updates of building codes as well as a variety of other provisions. It will not require zero-energy codes but it set up a process that will further study code improvements.

Two, we recommend going beyond McKinley-Welch provisions. And for DOE to assist cities and States in adopting improved codes as well as conducting additional research.

Third, we recommend providing tax incentives for zero-energy homes and buildings with the incentives eventually phasing out as market share becomes substantial.

And fourth, we recommend requiring that new Federal buildings as of a future date be zero-energy buildings. In this way, the Federal Government can be a leader.

While these things may cost a little bit more, citations I provided in my full written testimony show how they are highly cost effective in terms of the energy savings we will pay back the higher cost in just a few years.

The second area we recommend is doing more on appliances and equipment, building on the appliance and equipment standards program and also tax incentives to encourage the best equipment. In the interest of time, I won't go into details there, because I wanted to get to improvements to existing buildings, which are very important. Many of the buildings that will be standing in 2050 have already been built, and we need to make them much more efficient.

Some of the things we should do is have the Federal Government, again, lead by example. When buildings go through major renovations, do deep energy retrofits. Likewise, Department of Energy can do more to work with cities and States on energy use benchmarking and retrofit programs. And we also recommend expanding retrofit programs including the weatherization assistance program for low- and moderate-income families as well as adoption of the HOMES Act that Representatives McKinley and Welch have introduced.

In my written testimony I provide a few examples of crosscutting policies as well. And I am happy to answer questions about those as well. But since my time is up, I, therefore, look forward to your questions.

Thank you.

[The prepared statement of Mr. Nadel follows:]



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Testimony of Steven Nadel

Executive Director, American Council for an Energy-Efficient Economy
Before the Subcommittee on Energy of the House Committee on Energy and Commerce

Hearing on the Role of the Building Sector in Creating a 100 Percent Clean Economy in the U.S.

September 16, 2019

Summary

Recent ACEEE research finds that a set of 11 energy efficiency opportunities can together halve US energy use and greenhouse gas emissions by 2050. Five of these opportunities are in the buildings sector, and collectively these measures can reduce buildings sector energy use and emissions by a little over 50%. We also identify specific policies that together can achieve the vast majority of these savings economy-wide. In my testimony, I present specific policies that will spur building sector energy savings and emissions reductions, including policies addressing new buildings, equipment, and existing buildings as well as several cross-cutting policies that will spur efficiency improvements in buildings and other sectors.

Introduction

Thank you for the opportunity to testify. I am the executive director of the American Council for an Energy-Efficient Economy (ACEEE), a non-profit research organization. ACEEE was founded in 1980 by researchers at universities and national laboratories. We produce more than 30 reports and other research products each year on energy-saving technologies, programs, and policies. We have a long history providing input to Congress and state and local policymakers based on our research.¹

Halfway There: Energy Efficiency Can Cut Energy Use and Greenhouse Gas Emissions in Half by 2050

Earlier this week, ACEEE released a major report showing how energy efficiency can reduce U.S. energy use and greenhouse gas emissions by half by 2050, making a large contribution toward reaching long-term climate goals while also saving consumers and businesses money, providing jobs, improving resident comfort, and reducing the health impacts associated with energy-related air emissions.

Specifically, our analysis included 11 different efficiency opportunities, of which five address the buildings sector – improved appliances and equipment, zero energy new buildings, smart buildings, building retrofits, and electrifying existing buildings. Overall, we estimate that the 11 opportunities can reduce 2050 U.S. energy use by about 50%, reduce energy-related carbon dioxide emissions by 57%, and reduce total greenhouse gas emissions by about 50% (including greenhouse gases beyond carbon dioxide, such as methane and nitrous oxide).

¹ For example, we played a substantial role in the development of the National Appliance Energy Conservation Act of 1987 and of the efficiency provisions in the Energy Policy Acts of 1992 and 2005 and the Energy Independence and Security Act of 2007.

The buildings sector accounts for nearly 40% of energy use and emissions.² We found that 2050 buildings sector energy use and emissions can be reduced by a little over 50% (our analysis found slightly larger opportunities in the buildings and transportation sectors than in the industrial sector). No single measure dominates the savings – the overall savings require the combined effect of the many different measures as shown in figure 1 below.

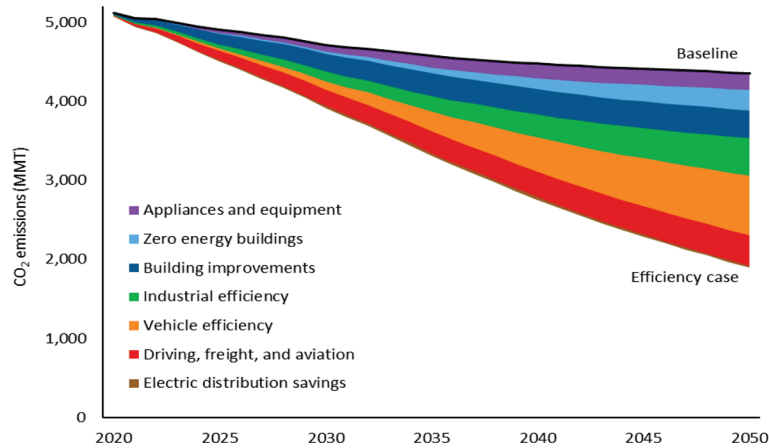


Figure 1. Carbon dioxide emissions reductions in the ACEEE *Halfway There* study. Building improvements include smart buildings, building retrofits, and electrification of existing buildings.

In addition, we conducted a policy analysis, looking at policies to help implement each of the efficiency opportunities we analyzed. Our policy analysis shows a path for achieving about 90% of the efficiency opportunity, a little more for commercial buildings and somewhat less for homes because of the difficulty convincing people to retrofit their homes. The allocation of savings by policy is illustrated in figure 2. A summary of our study is appended to my testimony, and the full report is available at www.aceee.org/halfway-there.

² 39% in the EIA projection for 2019 as contained in the *2019 Annual Energy Outlook*.

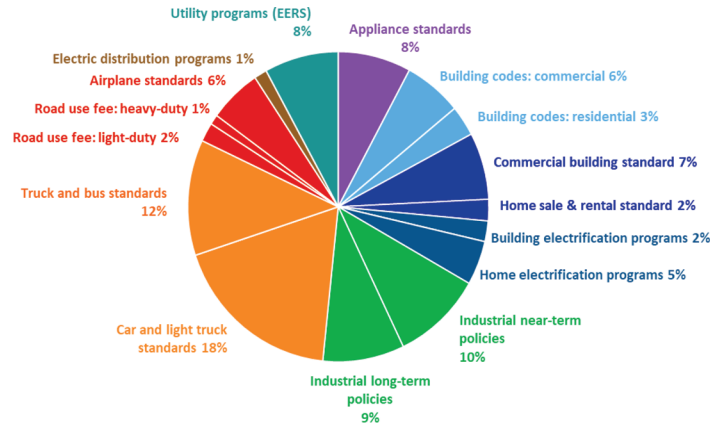


Figure 2. Distribution of energy savings by policy in the ACEEE *Halfway There* study.

In the remainder of my testimony, I will discuss policy steps to help achieve the building energy savings, starting with new buildings and proceeding to equipment, existing buildings, and cross-cutting programs.

New Construction

As the “law of holes” states, when you are in a hole, the first thing to do is stop digging. In order to address climate change, one of the first priorities is to stop building inefficient homes and buildings. While substantial progress has been made since 1980 in improving building codes, multiple organizations including Architecture 2030, the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE), the state of California, and Natural Resources Canada are all targeting adoption of codes by 2030 that require new homes and buildings to be zero energy or zero carbon when summed over a full year. Such buildings typically combine high levels of energy efficiency to reduce loads about 70% below typical new buildings, with on-site renewable energy systems to provide the remaining energy (and where use of sufficient on-site renewable energy is not possible, off-site renewable energy can be used). In order to encourage the movement toward zero energy and carbon codes by 2030, Congress can take a variety of steps:

1. Adopt H.R. 3962 introduced by Reps. David McKinley (R-WV) and Peter Welch (D-VT). This bill includes provisions promoting regular updates of national model codes and state codes, state and local “stretch” codes that go beyond the model codes, and better compliance with codes. It will not require zero energy codes but will set up a process that will further steady code improvements.
2. Go beyond the McKinley-Welch provisions to set targets for zero energy codes and to direct the Department of Energy (DOE) to assist cities and states in adopting zero energy or carbon codes. DOE should also assist model code bodies (e.g. ASHRAE and the International Code Council) to gradually ramp their codes down to zero energy or carbon levels. In addition, DOE should conduct R&D on ways to achieve zero energy performance in building types for which few examples of zero energy performance exist (e.g. hospitals and supermarkets, both building types with high energy intensity).

3. Provide tax incentives for zero energy homes and buildings, with the incentives phasing out once about a quarter of new homes and buildings are zero net energy.
4. Require that new federal buildings, as of a future date (perhaps three years from date of enactment) be zero energy buildings. In this way the federal government can be a leader, showing the way for others. While zero energy buildings generally cost a little more than conventional construction, the extra cost is recouped in lower operating costs.³ In the U.S., more than 500 zero energy commercial buildings have been documented.⁴
5. Strengthen federal requirements for the efficiency of new manufactured housing and new and rehabilitated housing that receives federal support (public housing, federally guaranteed loans, disaster rebuilding), with a process for continued improvements.

Appliances and Equipment

The U.S. has made much progress improving the efficiency of appliances and other equipment, driven by state and federal minimum efficiency standards, Energy Star, and utility and other incentive programs. But further progress is possible. For example, a report by ACEEE and the Appliance Standards Awareness Project (ASAP) identified 12 products that can save more than 1.5 “quads”⁵ of energy on a cumulative basis: residential water heaters, central air conditioners and heat pumps, showerheads, clothes dryers, refrigerators and freezers, faucets, and furnaces as well as commercial and industrial fans, motors, distribution transformers, air compressors and packaged air conditioners and heat pumps.⁶ Potential cumulative savings for these dozen products exceeds 60 quads (for comparison, the U.S. used about 101 quads in 2018).

All of these products are covered by the DOE equipment efficiency standards program, but unfortunately rulemaking activity at DOE has slowed to a crawl and no new standards have been issued since July 2017. Congress should continue to provide oversight, encouraging DOE to get moving again to establish strong, cost-effective standards. Congress should also consider tax incentives to encourage manufacturers to develop and sell even higher efficiency equipment. Specific policy recommendations include:

1. In order to encourage DOE to stay on track with regular updates to standards, and to create a pathway for progress if DOE does not act, Congress should sunset federal preemption of state standards at the time DOE misses legislative deadlines for revising standards.
2. Congress should also consider directly enacting new standards. Manufacturers and the energy efficiency community have a long history of negotiating consensus standards,⁷ and we hope to work with industry to develop some consensus standards based on existing state standards, ENERGY STAR specifications that now have high market share, and other negotiated approaches. Congress

³ Corvadae et al., 2019, *The Economics of Zero Energy Homes*, Rocky Mountain Institute. rmi.org/insight/economics-of-zero-energy-homes/.

National Renewable Energy Laboratory, 2014, *Cost Control Strategies for Zero Energy Buildings*. www.nrel.gov/docs/fy14osti/62752.pdf.

⁴ newbuildings.org/nbi-releases-zero-energy-building-count-and-trends-for-2019/.

⁵ A quad is a quadrillion (10¹⁵) British Thermal Units.

⁶ deLaski et al., 2016, *Next Generation Standards*, ASAP and ACEEE, aceee.org/research-report/a1604.

⁷ For example, in each of the bills noted in footnote 1.

also could enact the light bulb standard that DOE is trying to roll back in order to end legal uncertainty.

3. Congress should update federal tax incentives for heating and cooling equipment that were contained in the now expired 25C section of the tax code. We understand that Representatives Jimmy Gomez (D-Calif.) and Mike Kelly (R-Pa.) are planning to introduce such a bill soon. Likewise, we have suggested ways that efficiency can be added to Representative Tom Reed's (R-NY) "Energy Sector Innovation Credit Act of 2018," which does not presently include energy efficiency.
4. DOE should work with industry to expand R&D on improved efficiency equipment, and also on ways to improve equipment installation and maintenance (it is not uncommon for poor installation or maintenance to reduce efficiency of some equipment by 20%).⁸

Improvements to Existing Buildings

A substantial portion of the homes and commercial buildings that will be standing in 2050 have already been built. This reality makes retrofitting existing buildings critically important. Residential programs such as Home Performance with ENERGY STAR can reduce energy use by 20–30%, and retrofits saving 50% or more have been documented. Similar savings are possible in commercial buildings. In addition, smart building controls can typically reduce home energy use by 15% and commercial building energy use by 20% or more. Heating homes and buildings with high-efficiency heat pumps optimized for local climates can reduce primary energy use by an additional 20% or more. If the electricity is low-carbon or carbon free, even larger percentage emissions reductions result (citations for all of these figures can be found in ACEEE's *Halfway There* report).

In order to encourage these different energy efficiency measures, Congress should:

1. Have the federal government lead by example by requiring agencies to undertake deep energy retrofits at the time federal buildings are undergoing major renovations. GSA has done a variety of these projects; an evaluation by Oak Ridge National Laboratory of ten projects found average energy savings of 38%.⁹
2. Direct DOE to expand work with cities and states on energy use benchmarking and retrofit programs. More than 20 cities and three states now require commercial building benchmarking, which typically results in energy use reductions of 3–8% over a few years. New York City, Washington DC, and Washington State have gone a step further and required such buildings to be improved over a 5–15 year period to reduce energy use 20% or more (citations in ACEEE's *Halfway There* report). DOE should also expand R&D on ways to improve energy retrofits and lower retrofit costs.
3. Expand existing building retrofit programs and establish new programs. DOE now operates the Weatherization Assistance Program to weatherize the residences of low- and moderate-income families. In most states this program has a long waiting list – funding should be doubled or tripled so that many more homes can be served. In addition, a program should be started to encourage whole-

⁸ Domanski et al., 2014, *Sensitivity Analysis of Installation Faults of Heat Pump Performance*, NIST, www.nist.gov/publications/sensitivity-analysis-installation-faults-heat-pump-performance.

⁹ Shonder, 2014, *Energy Savings from GSA's Deep Energy Retrofit Program*, ORNL, www.gsa.gov/cdnstatic/NDEREnergySavingsReport5.pdf.

home retrofits by middle-income residents; Representatives Welch and McKinley have introduced such a bill, called the HOMES Act (H.R. 2043), and there also are related tax incentive proposals.

4. Expand federal support for applying information and communication technologies to improve building efficiency, including through the Smart Building Acceleration Act (HR 2044) introduced by Representatives Welch and Adam Kinzinger (R-IL).
5. Expand and better coordinate federal support for strategic energy management, a management approach that seeks continuous improvement to reduce energy use in large commercial buildings as well as manufacturing plants, including through DOE's 50001 Ready program.

Cross Cutting

In addition to specific policies directed at equipment and new and existing buildings, I would also urge Congress to consider several cross-cutting policies that would encourage efficiency investments in buildings as well as other sectors:

1. Energy Efficiency Resource Standard (EERS). An EERS is a set of annual energy saving targets for electric and natural gas utilities; 27 states have adopted such targets.¹⁰ Congress should consider a national program, to be operated by states. Such a bill – S. 2288 – has been introduced by Senators Tina Smith (D-MN), Angus King (I-ME), and Jeff Merkley (D-OR), and in previous Congresses by Representatives Ben Ray Lujan (D-NM) and Welch. Energy efficiency could also be incorporated into a broader clean energy standard.
2. Put a price on greenhouse gas emissions. Putting a price on greenhouse gas emissions would encourage investments in low-emissions technologies. This could take the form of a carbon tax or a cap and trade program. Such programs have been documented for 19 countries and 15 North American states and provinces. ACEEE research finds that these policies can be particularly impactful if a portion of the revenue collected is reinvested in programs to help households, businesses, and factories reduce their emissions.¹¹
3. Clean Free Market Act. The Clean Capitalist Coalition, including ACEEE, is now putting together a proposal to reduce taxes on a portion of the interest income from bonds and loans used to finance clean energy investments. We hope to have legislation introduced by the end of this year.¹²

Conclusion

Our research finds that energy efficiency can reduce U.S. greenhouse gas emissions by half, including emissions due to homes and commercial buildings, while saving consumers and businesses money and providing many other benefits. Congress can and should take the lead in adopting policies, as I have outlined, to help achieve these savings.

¹⁰ aceee.org/policy-brief/state-energy-efficiency-resource-standard-activity.

¹¹ Nadel, 2016, "Learning from 19 Carbon Taxes: What Does the Evidence Show?" aceee.org/files/proceedings/2016/data/papers/9_49.pdf.

Nadel and Kubes, 2019, *State and Provincial Efforts to Put a Price on Greenhouse Gas Emissions, with Implications for Energy Efficiency*, aceee.org/white-paper/carbon-tax-010319.

¹² Further information can be found here: cleantaxcuts.org/wp-content/uploads/ctc-cfma-conceptsummary-180828.pdf.

Mr. RUSH. I want to thank you, Mr. Nadel.

The Chair now recognizes Dr. Zimmermann. You are recognized for 5 minutes.

STATEMENT OF CURTIS J. ZIMMERMANN

Dr. ZIMMERMANN. Good morning, Chairman Rush, Ranking Member Upton, and members of the committee. I am Curtis Zimmermann, manager and government liaison of BASF Corporation. We truly appreciate the opportunity to—

Mr. RUSH. Will you please speak more directly into the microphone.

Dr. ZIMMERMANN. I am sorry?

Mr. RUSH. Would you please speak more directly into the microphone.

Dr. ZIMMERMANN. BASF Corporation is headquartered in Florham Park, New Jersey. We operate over 100 sites in 30 States and including several represented by members of this subcommittee. And BASF employs 20,000 people in North America. We are the largest chemical company globally providing a wide range of chemistry solutions for all sectors of the economy. At BASF, we create chemistry for a sustainable solution including a number of solutions for the built environment.

I provided detailed examples of our chemistry innovations used in sustainable construction in my written statement, so I'll highlight just a few today as BASF products and materials contribute to the efficiency and sustainability for the built environmental across the U.S., including our own buildings.

First, BASF corporate headquarter's building is one of the largest sustainable buildings in the State of New Jersey. Opened in May 2012, the 325,000 square foot building features a number of BASF products and chemistries that lower its energy consumption prolong its service life. Designed to achieve lead platinum standard in featuring high-efficiency HVAC, lighting, glass, and office equipment, our building uses much less energy than a conventionally designed building.

In addition to a number of water saving features and the use of recycled materials, it has a 30 percent improvement in indoor air quality, and more than half of the energy used for building is supplied by renewable sources.

Many of our facilities have also undergone major roofing upgrades utilizing our spray polyurethane foam technology. The seamless and monolithic application of the spray foam can be applied directly over an existing roof. This not only improves the efficiency and during of roof but also lowers labor and maintenance costs.

Additionally, our facility in Huntsville, Alabama, has twice been awarded the air pollution control achievement award by the city. In 2017, the site performed an LED lighting upgrade that saved 1 million kilowatt hours. And in 2018, it achieved platinum level 0 waste validation from UL. Currently the only manufacturing facility in the southeast to do so.

More importantly, however, is the sustainability solutions that our products provide for customers. For example, our HP+ Wall system embodies a new way to build homes. This innovative wall

works as a system and features two types of insulating foam, spray polyurethane foam and graphite enhanced polystyrene foam called NEOPOR. In addition to its superior insulating performance, the design capacity of the wall is up to 130 percent greater than the design capacity of a standard wall making HP Plus Wall stronger than those on typical houses. Because of its structural performance, this wall system can reduce the amount of lumber needed by up to 25 percent.

This innovation delivers efficiency and resilience so that our customers, who are builders, can better serve their customers, the home buyer.

This brings me to my last point, and that is innovation and technology deployment into the built environment. Embracing new ways to design, build, and construct homes, buildings, and infrastructure will further deliver efficiencies and sustainability across this important sector.

By 2050, the world is expected to hold 9 billion people who will not only need food and clean water but will also need shelter. How do we construct the buildings of the future that meet the demands and growing population while conserving our limited resources? What is the role of government in the process?

As an energy intensive company, BASF strives to be as energy efficient as possible. BASF has made efforts to play a leadership role by incorporating efficiency and sustainability into our own buildings as well as providing those same solutions for our customers.

The Federal Government, as the largest landlord in the U.S., has an opportunity to do the same. Government can utilize tools like energy savings performance contracts and undertake deep efficiency upgrades in its own building stock.

For example, BASF has already supplied a hundred million square feet of installed roofing formulations across many Federal agencies, including NASA, Navy DOE, and DOD. We appreciate these collaborations and hope that the government buildings are not unnecessarily wasting money on energy costs as that can detract from important mission-specific activities.

Thank you for the opportunity to testify about the solutions BASF is providing for the built environment. There is always more to do, and we look forward to working with you as you consider ways to further promote efficiency and sustainability across the important sector.

I look forward answering any questions. Thank you for your time.

[The prepared statement of Dr. Zimmermann follows:]

**U.S. House of Representatives, Subcommittee on Energy
Committee on Energy and Commerce**

**Hearing Entitled: “*Building a 100 Percent Clean Economy: Solutions for
the U.S. Building Sector*”**

**Testimony by Curtis Zimmermann, PhD, J.D. on behalf of
BASF Corporation**

September 20, 2019

Chairman Rush, Ranking Member Upton and members of the Subcommittee, my name is Curtis Zimmermann. I am Manager and Government Liaison for BASF Corporation. BASF Corporation is the largest subsidiary of BASF SE, the world’s largest chemical company. BASF Corporation operates over 100 sites in 30 states and employs 20,000 people in North America. Many of our sites are in states represented by the distinguished members of this Subcommittee, so we appreciate the opportunity to testify today.

At BASF, we create chemistry for a sustainable future. Chemistry is an enabler for many solutions across all sectors of our economy. We are pleased to be able to share with you today some of those solutions for the U.S. building sector where our products and materials are delivering efficiency, energy savings, and resiliency in residential, commercial, and infrastructure applications. Importantly, we are using them in our own buildings, as well.

My current role at BASF Corporation includes working across many of our business platforms to support technology deployment and innovation. In my 30-year career, I have managed research teams for over 20 of them and worked in both Europe and the U.S. I hold a PhD in chemistry, a law degree where I am licensed to practice in New York, and I personally hold more than 20 patents on commercial products. Technology and innovation are critical pieces to solving the challenges facing our world, which, by 2050, is projected to hold nine billion people who will need food, water, and shelter.

I would like to highlight three key areas in this testimony. First, I would like to share what BASF Corporation is doing to make sure our own buildings and assets have improved efficiency and resiliency. Next, I would like to share about what we offer our customers and how our customers use our products and solutions. Lastly, I would like to share how we are working with the government, about our optimism for the future, and how maintaining a commitment to ongoing innovation across the energy sector, including in buildings that use energy, is critically important.

BASF's Internal Efforts to Support Sustainable Construction

The quickest and most cost-effective way to extend energy resources is to make facilities more energy efficient and utilize renewable energy sources. One very important way that BASF maintains its commitment to sustainability is to ensure that our own buildings and assets are built, upgraded, and operated efficiently. With a product portfolio of over 600 different materials and technologies in 75 product categories, coupled with expert employees trained in building science, BASF leverages its own expertise to deliver high-performance solutions for our built environment. This is an important way to demonstrate that we believe in the sustainability, durability, and efficiency delivered by our own products and solutions. As such, I would like to provide a few examples:

1. BASF Corporate Headquarters – Florham Park, New Jersey

In May 2012, BASF Corporation officially inaugurated its new corporate headquarters building in Florham Park, New Jersey. Our building was designed to achieve Leadership in Energy and Environmental Design (LEED®) Platinum standards and features a variety of BASF-enabled construction products that lower energy consumption and increase the building's life cycle. The 325,000 square foot building is one of the largest sustainable structures in New Jersey. The building utilizes water-saving features that reduce indoor water use by 40%, incorporates native and non-invasive plants that require 85% less water to survive, and collects rainwater that is filtered, cleaned, and reused for both irrigation and toilets. The building also features a superior ventilation system, which is 30% higher than in conventionally-designed buildings and incorporates natural daylight that illuminates 75% of the interior.

Nonetheless, optimizing energy performance was the top priority for BASF. In that manner, the building features a strategic orientation, situated on the longest axis from east to west, which minimizes exposure from the sun while optimizing daylight. Additionally, the building uses energy-efficient air handling units, glass, lighting, and office equipment, which consume 20% less energy than a conventionally-designed building.

BASF will install its first large-scale solar project at our headquarters this year. In Spring 2020, BASF will host a ribbon cutting for our solar carport project that features 5,904 solar panels covering 60% of the parking lot. The project will offset the equivalent GHG emissions of 5.5 million passenger car miles and provide 55% of the electricity for our site. Excess solar power generation, managed by net metering, will be exported back to the grid.

2. Lighting and Environmental Stewardship – Huntsville, Alabama

BASF's Huntsville, Alabama facility, a site that produces three-way catalysts, is a site that walks the talk of environmental stewardship. All 600 employees are actively engaged in not only producing sustainable solutions for the automotive industry, but also ensuring their own facility

is just as sustainable. In 2018, the site was certified as Platinum Level Zero Waste Validation from UL, achieving 100 percent Landfill Diversion with 5 percent incineration with energy recovery. The BASF Huntsville facility is the first BASF facility and the only manufacturing facility in the Southeast currently validated to UL's Zero Waste to Landfill standard. This marks the second year that BASF Catalysts have achieved Zero Waste to Landfill Validation from UL and is the first year they achieved 100 percent diversion. Over the last year, the facility reduced trash by over 67 tons, diverted an additional 114 tons of waste from going to a landfill, increased recycling by 113 tons, and increased the direct reuse of waste materials by over 106 tons. Additionally, a new cooling water tower reduces the facility's water consumption by 200,000 gallons a year. Lastly, this is the second year that the city of Huntsville awarded the site the Air Pollution Control Achievement Award. In 2017, the site-wide LED conversion lighting project saved more than 1,000,000 kilowatt-hours per year of electricity (a 57% reduction) and reduced GHG emissions by more than 730 metric tons.

3. Site Roofing Upgrades – Alabama, New Jersey, New York

Each of BASF's facilities in McIntosh, Alabama, Iselin, New Jersey, East Setauket, New York and Tarrytown, New York have been retrofitted with our SKYTITE® closed-cell spray polyurethane foam (SPF) roofing system. This roofing system reduces energy consumption by having the highest aged R-value per inch at 6.3 of any insulation. The system also has the highest wind-uplift resistance providing substantial resilience, which is incredibly important in coastal areas experiencing severe weather events. Additional significant advantages of SPF include zero ozone-depleting, seamlessness and monolithic covering, i.e., it is self-fleshing and helps eliminate water intrusion. Also, because the system does not require any mechanical fasteners, which cause heat and cooling loss, there is no thermal bridging. SPF is lightweight and can be recoated indefinitely extending service life. SKYTITE® has also met the stringent Miami Dade County and Florida building code approvals.

4. Energy Service Upgrades – Tarrytown, NY

Our Tarrytown R&D site has embarked upon an aggressive energy efficiency program that includes a combination of newer energy efficient technologies e.g. HVAC, lighting, insulation and solar, in an effort to reduce energy consumption by more than 25%.

BASF is supportive of additional energy efficiency tools such as energy savings performance contracts (ESPC's) as offered by energy service companies (ESCO's) that provide a broad range of energy solutions including designs and implementation of energy savings projects, energy conservation, retrofitting, power generation and energy supply, and risk management. The savings in energy costs are often used to pay back the capital investment of the project. Energy Savings Performance Contracting, for example, has been growing at 13% per year and is very effective in quickly addressing the emissions from federal and other public buildings, allowing the retention of public monies for mission specific activities.

BASF's Commitments to Our Building & Construction Customers

A key pillar of BASF's sustainability strategy is economic success. Like many large industrial companies, BASF operates in a globally-competitive industry and must compete to profitably make and sell our products and solutions. This means that in addition to leveraging the efficiencies that we can deliver in our own buildings and assets, we must also work to make sure our solutions deliver the same, if not more, efficiency, durability and cost-savings for our customers, as well. I would like to share a few examples of the solutions our customers are using:

1. HP+ Wall System for Residential Construction

In 2015, BASF launched a new wall system for residential construction that maximizes efficiency, saves energy, and reduces the time it takes to construct a typical wall. This new wall system is called the HP+ Wall and features two types of insulating foams – spray polyurethane foam and graphite-enhanced polystyrene foam (NEOPOR®). This wall system is highly efficient and durable, but also substantially reduces the amount of lumber that would otherwise be required in typical home construction, up to 25%. This is a major cost savings for builders, who typically face some other their highest costs on lumber and labor.

Most importantly, however, is the insulating performance delivered by this system, which has allowed our customers, i.e., builders, to guarantee energy savings to their customers, i.e., homebuyers, of 30% better than code. Additionally, the design capacity of the HP+ Wall is up to 130% greater than the design capacity of a wall built with standard framing and OSB with full sheathing, making the HP+ Wall stronger than walls on a typical home. As such, equipping builders and consumers with solutions like HP+ Wall could not only improve the basic means for shelter in the event of unexpected weather disasters, but also allows homeowners to save on operational costs and energy bills along the way. BASF has continued to develop a series of HP+ Building Enclosure solutions, including vented and unvented attic assemblies, that significantly contribute to whole home performance.

2. NEOPOR® for Commercial Buildings

BASF's graphite-enhanced polystyrene foam, NEOPOR®, a rigid foam board insulation, is used in a variety of commercial applications. NEOPOR® has the lowest embodied carbon of any available rigid insulation in North America and is used in hospitals, schools, office buildings and mixed-use retail to name a few. NEOPOR® would be considered a "workhorse insulation" for its use in several commercial construction applications including exterior insulation and finish system (EIFS), wall cavities, precast concrete panels, commercial roofing, and perimeter insulation. In addition to its energy performance, NEOPOR® does not trap moisture and will not perpetuate mold growth, making it a desirable material for resilient construction.

NEOPOR® foam is manufactured in over 25 locations across the United States employing hundreds who manufacture and distribute it. This foam is also GREENGUARD Gold certified for indoor air quality making it desirable for children in schools. Based on its chemistry and supported by a third-party environmental product declaration (EPD), NEOPOR® uses the fewest raw materials by weight to achieve a set thermal performance.

3. Green Sense® Concrete for Infrastructure

Our Green Sense® concrete is another example of a ubiquitous building material that has been improved from conventional concrete manufacturing. It is more than just a product, rather a philosophy around sustainable concrete formulations. Green Sense® formulations are developed to use local ingredients and advanced polymer technology which reduces the energy utilization, water consumption and CO₂ emissions during manufacturing. The substantial sustainable contributions of Green Sense® typically include a replacement of up to 70% of cement with recycled materials, 25% less energy needed for formulation and application, 45% of CO₂ emissions saved and 10% of batch water saved.

Additional sustainability enhancements of Green Sense® could also be achieved if adopted for 3D printing of concrete. The DOD and NASA are advancing 3D concrete printing technology for Automated Construction of Expeditionary Structures (ACES). According to ACES, 3D printing of concrete structures “reduces cost by 40 percent, construction time by 50 percent and the use of concrete materials by 44 percent. Additionally, it more than doubles the strength of walls, improves thermal energy performance by 10 times, reduces manpower by 50 percent and reduces the overall need for hard labor.”¹ It is inevitable that these developments will be leveraged to the public good for providing highly functional and aesthetically pleasing affordable housing.

A. One World Trade Center

BASF’s Green Sense Concrete® was widely used in rebuilding One World Trade Center, previously dubbed Freedom Tower, in lower Manhattan, New York City. The soaring structure at 1,776 feet with 2.6 million square feet of office space is a marvel of design and engineering. Green Sense® Concrete was able to meet both the sustainable construction requirements, as well as the structural requirements, from the Port Authority of New York. According to BASF’s Eco-Efficiency Analysis, 15,838,267 kg of CO₂ were prevented in the construction of the building’s first 40 floors.

B. Tappan Zee Bridge

Green Sense® Concrete was able to provide formulations that met the tests for compressive strength, permeability, durability, flowability, shrinkage, slump and consistency to help the new Tappan Zee Bridge meet its 100-year service life requirements.

¹ Official website of the United States Marine Corps. <https://marines.mil/News/News-Display/Article/1943919/marines-engineers-conduct-a-first-of-its-kind-3d-printing-exercise>. Accessed 9/16/2019

BASF's Collaboration with Government and Commitment to Innovation

Another area where BASF has worked on providing solutions is with the government. As the largest landlord in the U.S., the federal government owns and operates 376.9 million square feet in 9,600 buildings across 2,200 communities.² This fact alone should compel the government to lead by example for the rest of the private sector. There are a few ways that BASF has already engaged with government and we look forward to more collaboration in the future. BASF has already provided more than 100 million square feet of federal roofing formulations installed in the U.S. alone, including buildings for NASA, Navy, Army Corp of Engineers, Department of Energy, Department of Defense and many other agencies.

For example, BASF's WALLTITE® commercial insulating air barrier system, which is low VOC and zero ozone depleting, is installed in the U.S. Department of Defense's BRAC 133 at Mark Center Office Complex in Alexandria, Virginia, and the U.S. Department of Homeland Security's, St. Elizabeths West Campus, right here in Washington, D.C. This product is ideal for existing building projects as it can protect the original exterior design and prolong the life of the structure all while delivering exceptional energy efficiency. BASF will continue to support these efforts for new and retrofit construction in the future and partner with the government on other projects as well.

Disaster Durable Solutions®

According to the National Oceanic and Atmospheric Administration (NOAA), the U.S. has sustained 250 weather and climate disasters since 1980 where overall damages/costs reached or exceeded \$1 billion (including CPI adjustment to 2019). The total cost of these 250 events exceeds \$1.7 trillion.³ In an effort to provide solutions, BASF created Disaster Durable Solutions® in response to the growing frequency and severity of natural disasters. Utilizing BASF's closed-cell spray polyurethane foam (ccSPF) and trained contractors, this solution can dramatically improve the durability of a home in a major weather event. For example, the effects on residential wind uplift performance using ccSPF were recently evaluated by the University of Florida Gainesville's International Research Center and the test results showed for a typical residential roof there was a 220% performance increase with three inches of ccSPF uniformly applied on the entire underside of the roof deck and a 124% performance increase with ccSPF applied at the joints between the rafters and the roof deck. In addition to spray foam's ability to deliver energy efficiency and prevent air infiltration, ccSPF also helps prevent water and

² General Services Administration. www.gsa.gov/real-estate/gsa-properties. Accessed 9/14/2019

³ National Oceanic and Atmospheric Administration. <https://www.ncdc.noaa.gov/billions/overview>. Accessed 9/18/2019

moisture from permeating the home by creating an integral vapor retarder, which is critically important in major weather events.

Future Innovations

Continuing innovation will be needed in building technologies to achieve maximum energy efficiency, sustainability and resilience. Improvements in the way we build structures that save energy and resources will need to be developed. This must couple with advancements in integration of the built environment between equipment within buildings, between buildings and ultimately the energy infrastructure to bring us closer to a clean energy economy. The DOE will play a critical role in advancing building technologies through the Building Technologies Office (BTO) Emerging Technologies (ET) Program, the Advanced Research Projects Agency-Energy (ARPA-E) and other DOE offices, as well as our National Laboratories. BASF will continue to develop innovative and sustainable solutions to support the demand for new materials for the future of the built environment.

Conclusion

In conclusion, BASF Corporation is committed to providing energy-saving and emission-reducing solutions for the built environment – for our own buildings, for our customers, and even for the government. There are many ways to foster greater adoption and utilization of these chemistry-enabled solutions and technologies. BASF balances our sustainability commitments and practices with economic success and environmental protection. There is no reason this same approach cannot be adopted across the buildings sector, as well.

Some of the actions BASF is taking with our own assets are applicable to other large industrial companies, like ours, or with government buildings, e.g., energy savings performance contracts. Yet, the commitment to innovation and technology deployment needs consistent support. Process efficiency and new technologies coupled with building science advancements are important drivers that should be fostered. We at BASF are optimistic about the future and the solutions we are providing for the buildings sector.

BASF encourages the federal government to take a leadership role in supporting innovation and technology deployment by utilizing these solutions in its own buildings and helping to demonstrate how those solutions can be important business drivers in our economy, as well. As the distinguished leaders on this Subcommittee are fully aware, sustainability is not a far-fetched impossibility and businesses, like ours, are embracing new opportunities to continue to profitably grow, create jobs, and deliver chemistry-enabled solutions across the value chain. The building sector is not and should not be exempt from innovation and technology advancement and we are pleased to be able to help push the envelope, literally, to perform in a manner that serves both the market and the environment.

Mr. RUSH. I want to thank you, Dr. Zimmermann.

The Chair now recognizes Mr. Keane for 5 minutes for the purposes of an opening statement.

STATEMENT OF TIM KEANE

Mr. KEANE. Good morning. My name is Tim Keane, and I am the international vice president at large for the International Association of Heat and Frost Insulators and Allied workers. And I greatly appreciate the opportunity to appear before the Energy Subcommittee today.

Since 1903, when our union was created, our members have always been known by many names: Pipe covers, asbestos workers, and now insulators. But we are and have always been the original clean energy workers.

While the value of mechanical insulation has been known for many years, it is often overlooked. I thank you, Mr. Chairman, for today's hearing and for this opportunity to share with you and your colleagues the importance of mechanical insulation.

To summarize my testimony, mechanical insulation is a proven, energy-efficient technology that promotes our national energy, economic, and environmental goals. Increased utilization of mechanical insulation saves energy for commercial buildings and industrial facilities that makes our Nation more energy independent. The energy savings of mechanical insulation also help our economy as our manufacturing sector comes more competitive in the global economy.

As a result of reduced fossil fuel energy consumption, mechanical insulation also reduces carbon emissions. As the House Energy and Commerce Committee and other congressional committees work to develop clean energy legislation, the insulators encourage your support for the following principles that Insulators Union General President McCourt shared with the congressional leadership last December.

The reality of climate change demands that we take immediate action to reduce carbon emissions. Another important reality is that our Nation will continue to require considerable fossil energy to ensure reliable base load power for today and tomorrow.

Our union does not discourage ambitious goals for a 100 percent clean energy economy, but our focus must be on what can be achieved now. The insulators also encourage your support for energy efficiency investments that have consistently enjoyed strong bipartisan support.

Clean energy incentives should include both technologies like mechanical insulation that are already available for increased utilization and investments in research and development to promote new clean energy technologies.

It is also imperative that clean energy legislation contain bipartisan building trades labor standards, Davis-Bacon prevailing wages, use of project labor agreements to ensure that clean energy jobs are good jobs.

These labor standards recognize that clean energy infrastructure should be built by the best trained and most productive and safest construction workers. The insulators support many specific legisla-

tive proposals to increase the use of mechanical insulation that you can see in my written statement.

Energy efficiency is often considered the fifth fuel behind coal, oil and natural gas, nuclear and renewable energy, or for this committee, energy efficiency should be considered the first fuel. Because the cheapest and cleanest energy is energy that is conserved.

As I conclude my testimony, I have focused on what the insulators are doing to achieve a clean economy. But I also want to recognize the important energy efficiency work that other building trades unions perform. It is unfortunate that some characterize building trades jobs as dirty or temporary jobs.

The truth is that building trades unions and our contractors invest 1.3 billion per year in our apprenticeship programs that produce the best trained, safest and most productive craft workers for long-term careers.

As Chairman Rush knows, one of the best apprenticeship programs in the Nation is my home, Local 17, that is located in Chairman Rush's district.

Thank you, Mr. Chairman. And I am looking forward to continuing this important conversation as we work to build a clean economy. Thank you.

[The prepared statement of Mr. Keane follows:]

TESTIMONY OF TIM KEANE
INTERNATIONAL VICE PRESIDENT AT LARGE
INTERNATIONAL ASSOCIATION OF HEAT AND FROST INSULATORS
AND ALLIED WORKERS
BEFORE
U.S. HOUSE ENERGY AND COMMERCE SUBCOMMITTEE ON
ENERGY
HEARING ON "BUILDING A 100 PERCENT CLEAN ECONOMY:
SOLUTIONS FOR THE U.S. BUILDING SECTOR

SEPTEMBER 20, 2019

**Testimony of Tim Keane, International Vice President At Large,
International Association of Heat and Frost Insulators and Allied Workers**

U.S. House Energy and Commerce Subcommittee on Energy

Building a 100 Percent Clean Economy: Solutions for the U.S. Building Sector.

September 20, 2019

Good morning Chairman Rush, Ranking Member Upton and Members of the Energy Subcommittee. My name is Tim Keane, and I am the International Vice President At Large for the International Association of Heat and Frost Insulators and Allied Workers, and I greatly appreciate the opportunity to appear before the Energy Subcommittee today.

Since 1903 when our union was created, our members have been known by many names: Pipe Covers, Asbestos Workers, and now Insulators, but we are and have always been the original clean energy workers. When our first members applied insulation on hot pipes at energy plants, steel plants and other manufacturing facilities, the primary purpose of the insulation was for worker protection. Very quickly it was discovered that insulation on mechanical systems would also generate significant energy savings.

While the value of commercial and industrial insulation, collectively known as mechanical insulation, has been known for many years, it is often overlooked. I thank you Mr. Chairman for today's hearing and for this opportunity to share with you and your colleagues the importance of mechanical insulation, and what our members do every day..

To summarize my testimony, mechanical insulation is a proven energy efficiency technology that promotes our national energy, economic and environmental goals.

Increased utilization of mechanical insulation saves energy for commercial buildings and industrial facilities that makes our nation more energy independent. The energy savings of mechanical insulation also help our economy as our manufacturing sector becomes more competitive in the global economy. As a result of reduced fossil-fuel energy consumption, mechanical insulation also reduces carbon emissions.

Energy Benefits - We estimate that implementing a comprehensive mechanical insulation maintenance program in the commercial and industrial markets would produce annual energy savings of 1.2 quads of primary energy or savings of roughly \$4.8 billion per year with a return of investments ranging from 25 percent to over 100 percent. These savings are achievable

because the U.S. Department has estimated that up to 20 percent of mechanical systems have missing or damaged mechanical insulation.

Economic Benefits - In addition to the job creation and job retention for the commercial and industrial sectors, increasing the utilization of mechanical insulation can create 89,000 good paying jobs in our industry. It is also important to note that 95 percent of the products utilized in this industry are manufactured in the United States. These jobs can't be outsourced.

Environmental Benefits - A comprehensive mechanical insulation maintenance and upgrade program could reduce 43 million tons of carbon dioxide.

As the House Energy and Commerce and other committees of jurisdiction work to develop clean energy legislation, the Insulators encourage your support for the following principles and policies that Insulators Union General President McCourt shared with the congressional leadership last December:

Achievable Over Aspirational - The reality of climate change demands that we take immediate action to reduce carbon emissions. Another important reality is that our nation will continue to require considerable fossil energy to ensure reliable baseload power for today and tomorrow. Our union does not discourage ambitious and aspirational goals for a 100 percent clean energy economy, but our focus must be on what can be achieved now.

Bipartisan and Balanced - Energy policy is often divisive, and the Insulators encourage your support for energy efficiency investments that have consistently enjoyed strong bipartisan congressional support. Clean energy incentives should include both technologies, like mechanical insulation, that are already available for increased utilization, and investments in research and development to promote new clean energy technologies. There should be a level playing field for all clean energy technologies.

Labor Standards - It is imperative that clean energy legislative proposals contain specific support for essential and bipartisan building trades labor standards (Davis-Bacon prevailing wages, use of Project Labor Agreements) to ensure that clean energy jobs are good jobs. These labor standards recognize that clean energy infrastructure should be built by the best trained and most productive and safest construction workers.

Support For Mechanical Insulation Incentives -

The Insulators greatly appreciate the important work that your committee has already produced to approve legislation to promote energy efficiency, and we encourage your support for the following mechanical insulation incentives, and I realize that some of these initiatives are not in your committee's jurisdiction

*Mechanical Insulation Incentive bill (H.R. 3349), legislation to provide tax incentives for greater utilization of mechanical insulation.

*Improve the Section 179 (d) tax incentive to ensure that mechanical insulation is fully utilized for commercial building energy efficiency improvements

*Improve Building Codes to require mechanical insulation upgrades for new construction and retrofit projects and maintenance for existing facilities

* Support mechanical insulation investments in public building projects with particular emphasis on U.S. military bases and health care and education facilities

*Support policies to maintain and improve our carbon-free nuclear energy facilities

*Support federal initiatives to promote Combined Heat and Power facilities

*Support federal initiatives to promote the construction of LNG export facilities constructed with Project Labor Agreements.

* Support increased utilization of mechanical insulation in Energy Savings Performance Contracts

* Support for a National Energy Efficiency Resource Standard (EERS).

Energy efficiency is often considered the fifth fuel behind coal, oil and natural gas, nuclear and renewable energy, but for this committee, energy efficiency should be considered the first fuel because the cheapest and cleanest energy is the energy that is conserved.

It is also often said that energy efficiency is the low-hanging fruit where energy savings are easily achievable. For the Insulators, we work to achieve energy savings, but we also see the fruit of potential energy savings fall from the tree and rot on the ground as we are missing opportunities to save energy by not doing more to save energy with mechanical insulation.

As I conclude my testimony, I have focused on what the Insulators are doing to achieve a clean economy, but I also want to recognize the important energy efficiency work that other building trades unions perform. It is unfortunate that some characterize building trades jobs as dirty or temporary jobs; the truth is that building trades unions and our contractors invest \$1.3 billion per year in our apprenticeship programs that produce the best-trained, safest and most productive craft workers for long-term careers.

As Chairman Rush knows, one of the best apprenticeship programs in the nation is my home Local 17 that is located in Chairman's Rush's district.

Thank you Mr. Chairman, and I am looking forward to continuing this important conversation as we work to build a clean economy.

Mr. RUSH. The Chair thanks Mr. Keane.

And now the Chair recognizes Mr. McIntyre, who is recognized for 5 minutes for the purposes of an opening statement.

STATEMENT OF ARN MCINTYRE

Mr. MCINTYRE. Thank you, Chairman Rush, Ranking Member Upton, members of the subcommittee.

I am pleased to appear before you today on behalf of the National Association of Home Builders. I would like to share our views regarding energy use within residential buildings and solutions that encourage energy efficiency that are market-driven and voluntary without jeopardizing housing affordability.

My name is Arn McIntyre. I am a green builder from Grand Rapids, Michigan. My company has focused on designing and constructing high-performance homes for 25 years. Most notably, my company built the first independently certified green home in the State of Michigan in 2002. I also served as one of the founding members of the committee that developed the first national green building standard in 2008, the NGBS.

As long-time leaders in the drive to make new and existing homes more efficient, one of the biggest challenges continues to be balance and efficiency with housing affordability. As energy efficiency standards become more stringent, home prices increase for new home buyers. In fact, NHB estimates that if the median new U.S. home price goes up a thousand dollars, more than 127,000 households would be priced out of the market or out of housing nationwide.

First and foremost, Congress must factor in housing affordability when looking at solutions for a 100 percent clean economy. According to a 2018 study, the Environmental Information Administration, the residential sector uses approximately 16 percent of the energy consumed in the United States. That is residential sector. Because new homes account for a small share of a total housing inventory, they use only a small share of the annual consumption.

In contrast, there are 130 million homes built prior to 2010 that are much less energy efficient than today's new homes. Therefore, in addition to housing affordability, any efforts to address the energy consumption of homes must prioritize the inefficiencies of existing homes over the higher performing new homes.

I would also caution the committee against proposing Federal mandates as a solution to building a 100 percent clean economy. Mandating energy building codes are requiring builders to reach net zero or near zero energy emissions, and usage is extremely difficult, costly, and is not consumer driven.

Many have suggested that mandates are an answer to improving residential energy efficiency in reducing greenhouse gas emissions. These are highly problematic and have unintended consequences.

As a Michigan State licensed building inspector and home energy rater, I am involved in the code process. To simply mandate compliance with more stringent energy codes makes little sense. Since the codes are developed at a national level, many of the energy efficiency provisions are based on national construction and cost savings which are of limited use on a local level.

Further, because new construction is already highly efficient requiring compliance with with more stringent energy codes yields minimal overall benefits yet can impose significant costs to new home contribution.

Finally, any Federal intrusion into the building codes adoption process could have catastrophic impact on each State's ability to implement codes that best fit their needs. Instead of focusing on mandates to reach its clean economy goals, Congress should support and facilitate voluntary above-code programs. Unlike mandates, these are driven by the market and recognized by consumers and result in veritable reductions in greenhouse gas emissions.

Programs such as the ICC 700, the National Green Building Standard, Lead, Energy Star, and DOE's Better Building program, all have proven track records for reducing energy usage and meeting other sustainability and high-performance goals. Multiple options of flexibility allow us as builders to choose the energy efficiency option that meets our individual needs for the market.

In conclusion, I strongly urge Congress to promote voluntary market-driven and viable green building intuitives in lieu of mandates to meet energy efficiency goals. These types of programs reduce lower total ownership costs through utility savings as well as provide the flexibility of builders need to construct homes that are cost effective, affordable, and meet consumer demand.

Thank you for the opportunity to testify here before you today. I strongly recommend that Congress seriously consider and address the housing affordability when exploring solutions for a 100 percent clean economy.

Thank you.

[The prepared statement of Mr. McIntyre follows:]



Testimony of Arn McIntyre

**On Behalf of the
National Association of Home Builders**

Before the

House Energy and Commerce Committee

***"Hearing on Building a 100 Percent Clean Economy:
Solutions for the U.S. Building Sector"***

September 20, 2019

Testimony of Arn McIntyre
 President, McIntyre Builders Inc.
 On behalf of the National Association of Home Builders
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Introduction

Chairman Rush, Ranking Member Upton, I am pleased to appear before you today on behalf of the National Association of Home Builders (NAHB) to share our views regarding energy use within residential buildings. My name is Arn McIntyre and I am a green builder from Grand Rapids, Michigan. As Principle at Performance Home Corporation and McIntyre Builders Inc, I have focused on designing and constructing high performance homes for 25 years. Most notably, I built the first independently certified green home in Michigan in 2002. I also served as one of the founding members of the consensus committee, that developed the first National Green Building Standard in 2008.

NAHB represents over 140,000 members who are involved in building single-family and multifamily housing, remodeling, and other aspects of residential and light commercial construction. NAHB's members construct approximately 80 percent of all new housing in the United States.

NAHB is leading the way to improve energy efficiency in the residential sector for new and existing homes. As a longtime leader in the drive to make new and existing homes more energy efficient while prioritizing housing affordability, this hearing offers a valuable opportunity for NAHB to examine the role clean energy plays in the housing market and to identify the challenges the industry faces in doing so.

This testimony emphasizes the following points:

- New homes are much more energy-efficient than the existing housing stock. More stringent energy conservation requirements for new homes will significantly increase the cost of these homes and harm housing affordability. This would encourage people to remain in older, less energy-efficient homes.
- Improving the energy efficiency of the 130 million homes built before 2010 that are much less energy efficient than today's new homes would significantly reduce emissions. This is a much more effective way to achieve energy savings than targeting new homes.
- Climate change mitigation programs that recognize and promote voluntary-above code compliance for energy efficiency have a proven track record and demonstrate that mandates are not necessary.
- Mandating net zero or near net zero energy emissions or usage is extremely difficult, costly and impractical in most if not all of the nation.
- Any federal intrusion into the building codes adoption process could have a dramatic impact on each states' ability to implement the codes that best fit their jurisdiction.
- Incentives play an important role in providing homeowners a cost-effective way to invest in energy efficiency.

Testimony of Am McIntyre
 President, McIntyre Builders Inc.
 On behalf of the National Association of Home Builders
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Residential Energy Usage Overview

Energy production and consumption is the largest source of global greenhouse gas (GHG) emissions. Greenhouse gases are chemicals that, when released into the atmosphere, have the potential to cause climate change. In recent years, how energy is produced and used has been receiving a lot of attention. Part of this attention has fallen upon the housing sector and the role it plays in generating greenhouse gases.

Much of the responsibility for tracking greenhouse gas emissions has been assigned to the Energy Information Administration (EIA), the statistical agency housed inside the U.S. Department of Energy. To do so, the EIA has divided end users into four broad categories – transportation, industrial, residential and commercial. In 2018, the residential sector used 11.9 percent of the energy consumed in the U.S.¹

But because new homes only account for a small share of the total housing inventory, they use only a small share of the annual energy consumption attributed to the residential sector. Therefore, any efforts to address the energy consumption of homes must take into account these discrepancies between the new and existing housing stock. Likewise, while individually, the impacts of each sector may be considered significant, any efforts to reduce greenhouse gas emissions are likely to be more effective if directed broadly across all sectors, rather than focused narrowly on one sector to the exclusion of others.

Mandates Problematic

Many have suggested that more stringent building energy codes or meeting other mandatory requirements, such as net-zero, are the only answers to improving residential energy efficiency and reducing greenhouse gas emissions. NAHB strongly disagrees, as both options are problematic and unnecessary.

NAHB has long been a supporter of the development and implementation of reasonable, practical, and cost-effective building codes and standards. We have established a highly knowledgeable and active member committee to oversee and participate in code development, as well as seasoned staff that are dedicated to advocating for builders and consumers. Our participation is evident with the International Code Council (ICC), ASHRAE, the National Fire Protection Association, and others, through which we aim to find workable solutions that are affordable and practical as well as safe and energy efficient.

State and local governments play a key role in the codes adoption process and determining the value of and need for certain code requirements initially developed at the national level. State and local energy code adoption processes typically consist of a thorough consideration of the code's applicability within the jurisdiction, along with costs, technology, and resources, among other factors. Since the codes are developed at a national level, many energy efficiency

¹ U.S. Energy Information Administration, *Monthly Energy Review*, August 27, 2019.

Testimony of Am McIntyre
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provisions are based on national construction and energy cost averages. There is also assumed availability of tools, training, technology and construction techniques.

Because many states and local governments don't fit the mold of the national averages, they frequently find the need to amend the model codes prior to adoption. Some states make few changes to the model codes, others hand-pick the provisions and/or amend certain requirements, and others use the model code as a baseline to create their own state-specific code. Any federal intrusion into the building codes adoption process could have a dramatic impact on each state's ability to implement the codes that best fit their jurisdiction. Likewise, federal mandates that impose building code requirements across the board will have similar unacceptable results. One reason the codes work is because they can be tailored to local conditions, market forces, and consumer wants and needs. A blanket mandate ignores these factors.

Further, any requirements for homes to meet net zero or near zero emissions or energy usage are even more problematic. The current demand for net or near zero energy homes represents a sliver of the housing market. Designed and built to produce as much energy as they consume, net zero homes require careful planning, which will increase upfront design and engineering costs. Using passive techniques, such as orienting the house to take advantage of the sun for heating and cooling, net zero design also creates further challenges because it requires treating the home as a system instead of discrete elements. This requires additional thought and consideration because changing one aspect of the design will affect another part of the house that one might ordinarily think of as separate or unrelated and additional modifications may be required.

With high-quality insulation and an air-tight building envelope, the amount of energy needed in the home decreases, but to achieve net zero, additional systems must be incorporated, such as solar photovoltaics (PV), solar hot water, and special controls for heat pumps to maintain needed comfort levels. Other aspects typically include highly-efficient windows, lighting, and appliances. While individually, some of these installations may be workable, considering zero energy generally requires the installation of most of them, the total costs can be prohibitive. In addition, some of these elements do not work well in certain geographic regions. Clearly, mandating net zero or near net zero is extremely difficult, costly and impractical in most if not all of the country.

While NAHB has long been an advocate for energy efficiency codes that are cost-effective and affordable for home buyers throughout the nation, the energy codes are growing increasingly stringent, increasingly unworkable and marginally cost-effective- at best. Mandating adherence to overly burdensome requirements – particularly for new construction – adversely impacts housing affordability, disadvantages new construction, and may not yield the intended results.

- Housing Affordability Must be Maintained
 Any federal energy mandates would hit the housing industry in a variety of ways. Like many industries, energy prices and production costs for energy-consuming raw materials and the machinery used in residential construction are a serious financial concern.

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Significant jumps in the costs of energy during the housing production process would ultimately translate into higher prices for the new homebuyer. Furthermore, measures to control the consumption of energy within the operation of a home- i.e., aggressive energy codes and standards, mandates or green building requirements, etc. – also increase the price of newer, more energy-efficient homes. This is problematic.

NAHB's research shows that housing affordability in the single-family market is at a 10-year low.² Only 56.6 percent of new and existing homes sold in the fourth quarter of 2018 (October through December) were affordable to families earning the U.S. median income of \$71,900. Although the national median home price decreased from the third quarter of 2018 to the fourth quarter, average mortgage rates rose by 17 basis points over the same period. This was the fourth straight quarterly rate hike and the highest rate level since the second quarter of 2011.

As a result, owning or renting a suitable home is increasingly out of financial reach for many households. In fact, almost a third of the nation's households are cost burdened and pay more than 30 percent of their income for housing.³ At the same time, net new households are being formed faster than new single family and multifamily homes are coming on line to accommodate them, so there is both a surge in need and not nearly enough supply.

And finally, making things worse, NAHB estimates that nearly 25 percent of the final cost of a single-family home and nearly 30 percent of the cost of a multifamily home is due to government regulations at all levels of government. This is further exacerbating the supply/demand curve and making the housing market even more challenging. For example, NAHB estimates that if the median U.S. new home price goes up by \$1,000, more than 127,000 households would be priced out of the housing market nationwide.

Clearly, the nation is experiencing a regulatory and housing affordability crisis. President Trump recognized this earlier this year when he issued an Executive Order Establishing a White House Council on Eliminating Regulatory Barriers to Affordable Housing through which he directed the agencies and others to address, reduce and remove the multitude of overly burdensome regulatory barriers that artificially raise the cost of housing development and help to cause the lack of housing supply.

Unfortunately, many of the energy efficiency suggestions made to date will only exacerbate the current crises. As each model building codes gets updated, the price to comply can increase exponentially. The change in the energy provisions from the 2006 IECC code to the 2018 IECC code, for example, are estimated to cost between \$4,500 to over \$9,000 depending on climate zone for an average sized home. Likewise, the

² Rose Quint, "[Housing Affordability Holds Steady at a 10-Year Low in the Fourth Quarter](#)," NAHB Eye on Housing Blog, February 14, 2019.

³ "The State of the Nation's Housing 2018." Joint Center for Housing Studies of Harvard University. 2018.

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national average cost for a typical residential 6-kilowatt photovoltaic system, a basic requirement for a net zero home, is close to \$18,000. Most potential homebuyers and those who are renovating or upgrading their existing homes do not have the financial resources to cover such exuberant costs.

NAHB recognizes that energy efficiency is in the best interest of the nation's population, economy, environment, security and energy independence in the long term. However, housing affordability should not be compromised, and voluntary initiatives and programs must be in place to incentivize industries to begin recording and reducing emissions instead of mandates.

- New Homes Already Efficient

New construction is more energy-efficient than existing construction because of better insulation, energy efficient appliances and HVAC equipment, among other improvements. For example, single-family detached homes built in 2000-2009 on average used about 100.1 Btu per square foot of heated area per year, in contrast to 120.6 Btu for homes built in 1970-1979 and 135.4 Btu for homes built before 1950. Although the size of new homes has increased, the total energy used on heating and cooling has not, especially when newer homes are compared to homes built before 1950.⁴ With the growing interest in voluntary efforts to further reduce energy usage in new construction, overall consumption is likely to continue to decrease.

Despite these gains over time, new homes are still being targeted for increased energy efficiency. This makes little sense. Of the 137 million houses in the U.S., 130 million were built before 2010 and on average, approximately 1 million new homes are built every year. In other words, the housing stock is being replaced very slowly. If the focus of federal energy efficiency efforts remains targeted on new construction, it will take decades to reach reduction goals because in 20 years, 68 percent of the U.S. housing stock will still be pre-1990. Clearly, targeting new construction through building codes or other mandates makes little sense in the broader scope.

Further, if policies are adopted that apply more stringent energy conservation requirements to new homes, the cost of these homes will significantly increase. This may encourage people to remain in older, less energy-efficient homes, which would result in higher energy usage, higher greenhouse gas emissions, and lower standards of living, among other impacts. Any policies must address all sources equally and not inadvertently penalize new construction. To realize real energy savings, Congress should focus on retrofitting the existing housing stock.

⁴ Emrath, Paul, Ph.D. and Joshua Miller, Ph.D., "How Much Energy Homes Use and Why," HousingEconomics.com, November 2014.

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- Occupant Behavior Significantly Impacts Energy Usage

Household behavior, such as how long lights are left on, can have as great an impact on residential electricity consumption as the number of built-in appliances or other amenities provided by home builders. In fact, the energy-use impact of items purchased by the occupants after a home is built can be twice as large as the impact of items typically installed by a builder.⁵ In other words, even the most stringent building energy codes will not guarantee measurable energy use reductions. Even a net-zero home, can waste a tremendous amount of energy if the occupant does not subscribe to the concept of efficiency.

Clearly, occupant behavior is a significant factor in energy consumption. Electricity use (not including space heating and cooling) accounts for over 70 percent of energy use, irrespective of when a home was built. Leaving the television on, doing laundry, running the dishwasher, and even working from home can all drastically increase energy use in a home and thwart energy efficiency efforts. Because of this, relying on builders alone to meet specific mandates will not meet overall goals and could, due to cost issues, undermine the overall federal effort.

NAHB strongly discourages Congress from including mandates, such as building codes or meeting a net zero standard as solutions toward a clean economy. Building codes have little to offer in the form of emissions reductions and can impose significant costs on new home construction, supporting industries, and, ultimately, consumers. Rather, Congress should support voluntary programs, retrofitting existing buildings, education and other policies aimed at encouraging consumers to use energy more wisely.

Voluntary Programs Promote Energy Efficiency

NAHB supports climate change mitigation programs that recognize and promote voluntary-above code compliance for energy efficiency in lieu of mandates. There are a number of programs, certifications, and other options that recognize homes that are built following high-performance or green practices and show verifiable reductions in greenhouse gas emissions. These programs and participation in them demonstrate that mandates are not necessary. In the markets where consumers support sustainability and energy efficiency, these programs and others are successful in promoting and facilitating their adoption and the associated benefits.

- National Green Building Standard Invites Efficiency

NAHB continues to lead the way to improve energy efficiency in the residential sector for new and existing homes. NAHB launched the development of a green building standard for residential buildings, now known as the ICC 700 National Green Building Standard (NGBS), in 2008. The NGBS is an affordable yet rigorous standard that applies to all types of residential buildings, from single-family homes to multifamily buildings of

⁵ Emrath, Paul, Ph.D. and Joshua Miller, Ph.D., "How Much Energy Homes Use and Why," HousingEconomics.com, November 2014.

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all sizes, retrofits and land development. It focuses on energy efficiency, water conservation, resource conservation, indoor environmental quality, site design and home owner education and is the basis of a national certification program administered by the Home Innovation Research Labs. This rigorous certification requires buildings to improve in every category to achieve a higher certification level. The NGBS is also the first and only residential green building standard approved by the American National Standards Institute (ANSI), which guarantees that the NGBS was developed using a true consensus process.

The NGBS continues to evolve and is updated on a continuous basis to quickly respond to new solutions and innovations in design, materials, technologies, commissioning, building operation strategies, market preferences, financial transactions, etc. The NGBS is directly tied to the national building codes published by ICC to ensure compatibility and seamless implementation by all stakeholders, including developers, designers, jurisdictions and building operators. The upcoming 2020 edition of the NGBS is expected to be released in early 2020. Unlike building codes, the NGBS becomes effective and available immediately after its publication. This allows designers and builders to take instant advantage of the updates and not have to wait for the standard to be adopted by each local jurisdiction. The NGBS has proven to be a useful and relied-upon voluntary option for green building, as nearly 190,000 units have been certified, to date.

- Efficiency Options Create Market Demand

Because one size never fits most, it is important that builders have choices when it comes to finding strategies to reduce energy usage. As such, NAHB strongly opposes any federal mandate because they typically lack the flexibility needed for realistic, widespread application. Voluntary, above-code programs such as ENERGY STAR for homes and DOE's Better Buildings program have proven track records reducing energy usage. Flexibility in program choice allows builders to choose the program or green certification that best suits their needs and the desires of the homebuyers based on their ability to afford and willingness to pay for the associated above code features. NAHB's *What Home Buyers Really Want* survey also suggests that there is significant market demand for ENERGY STAR homes – when asked to rank 175 features based on how essential they are to a home-purchasing decision, ENERGY STAR appliances, windows, and whole-house certifications ranked among the top ten most wanted features. Such brand recognition demonstrates that there is a demand for voluntary, above-code federal programs, allowing for competition and choice in the market.

NAHB strongly urges Congress to promote voluntary, market-driven, and viable green building initiatives. These programs promote lower total ownership costs through utility savings as well as provide the flexibility builders need to construct homes that are cost-effective, affordable, and appropriate to a home's geographic location.

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Incentives Crucial to Success

Incentive programs are an important tool to reduce the barriers that many energy efficiency opportunities pose and encourage more home owners to invest in energy efficiency. For example, due to the high initial costs associated with purchasing and/or installing many energy efficient features, many homeowners are unable to finance desired or necessary upgrades. In those instances, without any assistance, those homeowners would likely forego the improvements. Incentives provide benefits to both parties and have proven to be an attractive alternative.

Tax incentives see the fastest results and are the most effective at advancing energy efficiency improvements. Sections 25C for qualified improvements in existing homes (building components), 45L for new homes and 179D for commercial buildings have permeated the market and assisted many families and building owners to invest in efficiency. Not only does this reduce energy consumption, NAHB estimates that for every \$100,000 spent on remodeling, 1.11 full-time equivalent jobs are created. The remodeling activity generated by the 25C tax credit in 2009 was associated with over 278,000 full-time jobs. Unfortunately, because these tax incentives keep expiring and being retroactively renewed, the positive impact of these incentives has decreased since 2011.

Other opportunities to help fund upgrades could include grants, insurance discounts, interest rate reductions, increased property valuations or other options. We urge Congress to continue to identify and institute different incentives, programs and awareness campaigns so that it can optimize participation in energy efficiency efforts and do so without establishing unnecessary mandates. In doing so, Congress is urged to target upgrades to the existing housing stock, as this demographic is the biggest consumer of electricity within the residential sector.

Conclusion

NAHB wants to work as a partner with all levels of government to encourage energy efficiency, however, we must also make sure that housing affordability is not jeopardized in the process. NAHB urges Congress to focus on solutions that are market driven, such as above code voluntary programs and other incentives, and to focus on increasing the energy efficiency of the existing housing stock. Any federal mandates would have a negative impact on housing affordability and will prevent healthy competition in the marketplace. NAHB looks forward to working with the committee to find reasonable solutions to get to a 100 percent clean economy.

Mr. RUSH. Well, thank you, Mr. McIntyre.
The Chair now recognizes Ms. Beardsley for 5 minutes for the purposes of an opening statement.

STATEMENT OF ELIZABETH R. BEARDSLEY

Ms. BEARDSLEY. Thank you, chairman. Thanks to the leadership and members of the subcommittee. I am honored to join you today on behalf of the U.S. Green Building Council, a nonprofit organization. We are best known for our leadership in energy and environmental design, lead green building system.

Through lead and other initiatives, we drive sustainable and high-performing buildings that improve the quality of life for all. We thank the subcommittee for this attention to progress on buildings in support of the 100 by 50 goal.

While climate risks are ever more apparent and urgent, the good news is that we can do this. The solution set is robust and growing to meet the challenge. This is certainly true in the building sector where we have much of the technology and can start now.

Deep efficiency is possible and being achieved every day in places like Texas where a recent story reported on a family power bill being cut in half after they rebuilt to modern code post Harvey.

We can deploy these cost-effective, commonsense solutions and reduce emissions along the way while creating jobs. The recent energy efficiency jobs in America report finds this to be—this sector to be one of the Nation's biggest employers, as noted by the chairman.

In fact, building technologies are getting so good, available, and low cost that net zero is no longer merely an aspiration but increasingly a reality. For example, this year we recognized the Entergy office in Little Rock as the first LEED Zero-certified building in the U.S., and others are in the pipeline. In the New Buildings Institute net zero database shows more than 600 buildings that are verified or emerging as net-zero energy.

Net-zero buildings are on the rise because these high-performing buildings are cost effective over their life cycle. When you build or retrofit a building to utilize smart technology, modern efficient heating and cool, highly insulated envelopes, and add on-site renewable energy, the results are highly cost effective, resilient, and comfortable building.

Study after study shows that high-performing buildings are valued in the commercial market with price and rent premiums, improvement in net operating income, and (inaudible) times.

Just this week, a new report from U.S. GBC Massachusetts showed that net-zero buildings can be built with little to no additional cost, meaning pay back times were as short as a year. And they found that existing office buildings retrofitted to net energy with renewables can produce a return on their investment in 5 to 6 years.

Now, as for single-family homes, the Rocky Mountain Institute studied the incremental cost of building net-zero homes in four U.S. locations. RMI found the cost to build a zero-energy-ready home to be between 0.9 percent to 2.5 percent over a comparable code home and concluded the cost increase is modest, far less than consumers,

builders, and policymakers realize while predicting costs will continue declining over time.

To put in perspective the benefits, the Discovery School across the river in Arlington is in that net-zero-energy school. With the money saved from utility bills, the school has funded two additional full-time teachers this year. And in the Federal space, the NREL campus in Colorado features a net-zero building built at cost within the regional construction cost average.

With these positive trends, we see many options for bipartisan progress on a suite of approaches. Not every building needs to be net zero, but we can aim to give everyone the opportunity to benefit from modern building methods on new buildings and retrofits to optimize energy efficiency.

Even when cost effective, improvements face other real and perceived barriers that are hindering progress.

Policy has a critical role in accelerating implementation, and a suite of approaches can best speed the rate of adoption while enabling continued American innovation.

Our statement includes a wide range of measures for consideration. To highlight a few, first, we should reestablish and expand Federal agency targets for annual improvements and energy efficiency, renewable energy, and other key metrics, and make needed changes to unlock the use of contracting mechanisms that leverage private funds for public efficiency and renewable projects.

Second, Federal agencies have a number of existing programs providing funds to State and local governments used for construction. These programs should ensure that Federally funded buildings are highly efficient and resilient, protecting Federal investment, and aligning outcomes with goals. Additional programs could help feed States and cities in improving public buildings.

Third, we see many positive improvements in the private sector. Financial incentives can help bring attention to these potential savings, including to small business which may lack technical capacity. Different financial models and ensuring efficiency is properly valued can also break down barriers. Transitioning our building sector to be high performing and resource efficient is financially beneficial and is taking place now throughout country.

The building sector could represent significant progress towards the 100 by 50 goal. To accelerate this transformation, an integrated set of strategies are called for.

I look forward to discussing more in the questions. Thank you.
[The prepared statement of Ms. Beardsley follows:]

Written Statement of
Elizabeth R. Beardsley, P.E.
U.S. Green Building Council

House Committee on Energy and Commerce,
Subcommittee on Energy

Hearing
"Building a 100 Percent Clean Economy: Solutions for the U.S. Building Sector"

September 20, 2019

Chairman Rush, Ranking Member Upton, and Subcommittee Members,

I am greatly honored to join you today on behalf of the U.S. Green Building Council (USGBC). USGBC, best known for the Leadership in Energy and Environmental Design (LEED) green building rating system, has been engaged in reducing buildings' contribution to climate change throughout our 25 year history.

We thank the Subcommittee for holding this hearing and calling attention to ways the Congress can help accelerate progress on buildings.

We applaud the Committee in its leadership and vision in adopting the 100x50 target. Achieving a 100 percent clean economy by 2050 reflects the science – embodied in the IPCC's [1.5 degree report](#) last fall – showing not only the risks from changing the climate, but that we can reduce the most severe impacts by acting decisively now.¹ The good news is that we can do this. We recognize the goal is ambitious; buildings are a place we can get started, and everyday Americans, businesses and families, can see immediate benefits. We have much knowledge already, especially in the buildings sector, and there are opportunities to use policy to scale the implementation of technologies already in the market, while continuing research, development, and deployment in areas needed.

In sum, to meet the climate goals needed to protect our future, we need to ensure that throughout the country, building owners, operators, and occupants have the opportunity to benefit in this transition; to improve their buildings, saving money, conserving resources, and building value, while decreasing greenhouse gas, or carbon, emissions as well. Giving businesses and individuals the information and tools to fill gaps, providing financial incentives to overcome market barriers, and leveraging the federal agencies to demonstrate low carbon high performing buildings, are some of the policy options available, that make sense for business and economic reasons, while making progress towards our emission reduction goals.

New buildings can be designed, built, and operated to be net zero carbon, using such technologies as well insulated building envelopes; highly efficient energy and water systems; onsite renewable energy generation; alternative or renewable energy heating, cooling, and water heating; and integration with electric grids as they also move towards clean energy.

In fact, we are seeing a huge increase in buildings recognized as net zero energy, now at [over 600](#) emerging or verified in the U.S. We're excited to see the school sector in particular embrace net zero concepts, with examples such as nearby Arlington's Discovery School, which has been so successful the County has two other net zero schools in the pipeline. Net zero is available to homes as well, for example

¹ IPCC, 2018: Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.*

in the [Depot Neighborhood](#) of Traverse City, Michigan, where Habitat for Humanity chose to pursue Net Zero Energy Housing because it reduces the lifecycle cost with "little-to-no utility bills each month which allow families to focus their income on important things like education and supporting local businesses."

The emissions related to the materials, products, and energy used in the construction process are getting more attention, and there is progress here as well. Sometimes referred to as "embodied carbon," these impacts are relatively small compared to operations over the life cycle of a building, but may be proportionately significant in the near term, including in the time horizon of 2030 and 2050. Companies like [Big River Steel](#) in Arkansas are lowering their emissions using state of the art technologies to produce steel more energy efficiently than competitors, giving it a business advantage. And companies like Johnson Controls and Schneider Electric not only invest in manufacturing more efficient equipment, but also in their own facilities; notably, each was recognized by DOE for [reducing energy consumption by 26%](#) over 7 to 8 years.

Achieving improvement in **existing buildings** is critically important as well. In developed economies like ours, more than half of the buildings that will be in use in 2050 are [already built](#). Here there are many opportunities to improve envelopes with insulation, update building energy and water systems, modernize control systems, and implement other retrofits.

These actions have valuable **co-benefits** for owners, occupants, and communities more broadly. For example, retrofitting of existing buildings saves owners and operators money on a life cycle basis, from energy and water savings and often more durable materials and equipment that last longer. Renovations done properly can improve indoor environmental quality to support wellness and comfort of employees and residents. Increased indoor environmental quality in turn benefits the economy, such as with increased productivity, fewer lost work days, and fewer emergency room visits. Importantly, renovating buildings creates local jobs, ranging from trades and construction workers, to engineers and architects.

These benefits are felt locally, and directly. For example, a local TV station in Rockport, Texas related the "silver lining" that when families faced rebuilding after Hurricane Harvey, they did so with the city's updated building requirements, such as insulated windows, and as a result, families are saving money on their bills. As quoted in the [story](#), one family "looked at our electricity bill, and we are using 46% less electricity than we did before the storm."

Moreover, net zero energy and net zero carbon buildings are **more resilient**, and will more readily be able to maintain operations or return to service more quickly after a storm. We know this from examples like one of our member's office in Puerto Rico, which had been renovated to meet sustainability goals. Following the devastation of Hurricane Maria, the Álvarez-Díaz & Villalón (AD&V) office space returned to a fully functional work space within a few days, a feat not typical in the area at the time. Because of this quick recovery, the office also served as an informal community gathering place and a temporary command center.

The Federal government has numerous tools and we support a **broad suite of strategies** to accelerate this work. These fall into three categories:

- (1) Federal leadership in its own building portfolio
- (2) Federal collaboration with state and local government
- (3) Federal programs targeting the private sector or economy wide change

As outlined below, we see many opportunities to increase the impact of these approaches, in ways that support a robust economy, save money, provide high quality, livable, and healthier spaces, and create jobs here at home, while accelerating low and zero carbon buildings practices.

Increase Impact in Federal Buildings

The federal government generally has been a leader in its approach to its own buildings. For example, the National Renewable Energy Lab doesn't just study these topics, it has put them into practice. NREL incorporates state-of-the-art energy efficiency and renewable energy technologies into its buildings, several of which are operating at net zero energy, such as the award-winning LEED Platinum [Energy Systems Integration Facility](#). The NREL facility was built at construction costs within the regional average.

GSA, DOD, and other agencies have saved energy and water, and along the way saved many millions of dollars, through construction and leasing policies, deployment of performance contracting and other public private partnership models, and use of third party certification. GSA has reported, for example, that sustainable building standards helped GSA avoid more than \$250 million in energy and water costs from 2008 to 2014.² Please refer to my June 11, 2019 testimony before the House Committee on Transportation and Infrastructure, [Subcommittee on Economic Development, Public Buildings, and Emergency Management](#) for additional information on energy efficiency and resiliency in the Federal agencies.

Federal agencies can have even greater impact in conserving energy and water, saving money and resources, while lowering the carbon impact of their building portfolios and providing high performing, spaces to support productivity and wellness of federal employees. **Broadly speaking, key policies to accelerate federal building decarbonization include setting goals; tracking and reporting progress by agencies; updating building energy requirements and adding net zero operations targets; eliminating barriers such as counterproductive time limits on clean energy contracts; and ensuring adequate resources.** Specific recommendations include those highlighted below.

- **Federal agency goals** for key metrics such as energy use, water consumption, renewable energy, and efficiency investment such as performance contracting, should be continued to ensure all agencies are engaged in and benefit from efficiency.
- Updating the **Federal energy efficiency performance standards**, established by the Department of Energy for all agencies, would help reduce federal energy intensity and associated carbon emissions.
- Such metrics and updated standards are included in provisions such as those in **S. 1857, Federal Energy and Water Management Performance Act of 2019** and **H.R. 3962, Energy Savings and Industrial Competitiveness Act of 2019**.
- Federal agencies can be encouraged to attain **net zero operations at key facilities**, to showcase American innovation as well as serve as hubs and operations centers. Phased in goals for agencies to achieve net zero operations at a percentage of their portfolio, with flexibility to prioritize facilities, could help their progress.
- Federal facilities can also support the transition to electric vehicles (EV) with provision of **EV charging stations** for employees and where appropriate, the public. Combined with renewable energy generation, this can over time achieve significant carbon reductions.
- For leases, there is opportunity to strengthen the applicability of and compliance with **efficiency and green lease provisions**, and to further ensure cost-effective efficiency measure requirements are implemented.
- Federal facilities, campuses, and land, can further utilize **green infrastructure** and stormwater management to reduce strain on local waterways, storm drains, and wastewater systems, building off of what is required under EISA 2007 for new development. These approaches reduce carbon emissions by reducing the need for potable water (including the energy used for producing, treating, and pumping that water), and can reduce wastewater treatment related

² GSA, [2015 Strategic Sustainability Performance Plan](#).

emissions as well. Legislative direction and goals for applying these strategies, such as provided in **S.1857** could be helpful.

- Several contracting provisions could also be updated to reflect current conditions and opportunities. Federal agency achievement related to renewable energy could be increased with extension of allowable timeframes for power purchase agreements, as provided in **H.R.932 - Renewable Energy Certainty Act**. Agency use of **Utility Energy Service Contracts** provisions could also benefit from an extension in permissible contract length, while their use of **Energy Savings Performance Contracts** could be increased with specific directives and clarifications, such as in **H.R.3079 Energy Savings through Public-Private Partnerships Act of 2019**.
- Ensuring consistent use of **life cycle analysis** could be valuable to support Federal agency decision-making.
- With respect to Federal planning, we support continuation of **agency sustainability plans**, along with tracking and reporting, and are pleased to see that the recently issued Implementing Instructions for Executive Order 13834 include these critical requirements. The agency scorecards are also important and highlight some specific areas for further attention. These could potentially be expanded to incorporate additional metrics.
- Ensuring adequate continued funding for the **GSA Office of High Performing Green Buildings** is key to continued progress, as well as authorization of and funding for **FEMP** as in **S. 1857**, which plays a critical role along with GSA in supporting government-wide energy and water efficiency and sustainability, for buildings and government operations. FEMP is a hub for best practices and provides services to help agencies implement improvements, including procurement through energy savings performance contracts, utility energy service contracts, and distributed energy. Important, FEMP has also developed tools for tracking and reporting GHG emissions associated with building operations.

Target Collaboration with State Government

The Federal government also has an important role in collaborating with state governments to advance building performance, including encouraging low and zero carbon buildings. **Approaches to engaging with states include increasing building standards applicable to construction that uses federal funding; establishing incentives for low carbon buildings in competitive grant programs; offering targeted programs to spur low carbon retrofit and construction of public buildings; supporting State Energy Offices; providing tools and technical assistance; and supporting leadership and peer to peer networks.**

Specifically, Congress can help advance state and local government actions to decarbonize buildings, such as through:

- **Federal financial assistance programs to states** can be aligned to support high efficiency construction – through the use of baseline requirements and competitive criteria. Specifically, when federal programs provide funding for construction or renovation, ensure that the outcome is highly energy and water efficient, and to the extent possible, incorporates low and zero carbon strategies and practices. For example, past allocations of HUD CDGB-DR funds have required funded new construction for replacement buildings to be green certified, to ensure highly efficient and quality outcomes. And, the Disaster Recovery Reform Act enacted about a year ago incentivizes state and local governments receiving funds to implement modern building codes. More could be done using green building systems, energy efficiency standards and net zero energy and net zero carbon buildings to systematically ensure that across the country, federal funds are pushing this transformation and demonstrating what is possible.

- Likewise, where there are **existing competitive grants for state and local governments**, Federal programs can incentivize deeper reductions in carbon and achieving net zero energy or carbon, by awarding more points for applications that commit to higher tiers of performance.
- Financial support can be focused towards improving performance of state and local buildings, such as through Private Activity Bonds as provided in the **Public Buildings Renewal Act (H.R. 1251)** or directly through programs like the Energy Efficiency and Conservation Block Grant Program as would be reauthorized in **H.R. 2088** and the Energy Efficient Public Buildings grant program as would be reauthorized in **H.R. 2119**.
- Supporting states in implementing policies like the benchmarking provision in **H.R. 2119**, as passed by this Committee, is another valuable tool that helps provide building teams with information on energy performance and comparison against peers, and is proven to lead to increases in efficiency.
- Support for state energy offices is also critical, as these offices are on the front line working with Governors, agencies, and others to craft and implement state specific policies impacting building energy use as well as opportunities for building-grid interaction, distributed energy resources, and planning for resiliency. This program includes the **Weatherization Assistance Program** which has helped low income families save millions on energy bills. We thank the Committee for supporting the House-passed increase for DOE **State Energy Program (SEP)** SEP to \$70 million for FY'20, as well as the SEP reauthorization bill (**HR 2114**) passed earlier this month.
- Providing adequate resources and direction to **DOE's Energy Efficiency and Renewable Energy (EERE)** division and to **EPA's ENERGY STAR** programs helps state and local governments as well as the private sector, with a range of programs from the highly utilized and successful ENERGY STAR Portfolio Manager system for buildings, as well as the Better Buildings program, with industry-specific best practices and technical support. Committee direction to ensure that appropriated funds are properly and timely spent and that the offices are fully staffed is also helpful.
- **EERE's Building Technologies Office** also plays an important role with programs focused on buildings, including research and development; we encourage increased attention to late state deployment of building efficiency. Additional funds and programs targeting building-grid integration, distributed energy storage, electrification of heating and cooling (including RD&D) and EV charging at buildings would provide further opportunities to leverage state and local governments in transitioning to the low carbon economy through buildings.

Enable the Private Sector

Federal action can also help open up and advance decarbonization of buildings throughout the private sector. As noted above with respect to state projects, when Federal funds are used for private projects, **building standards should be used to ensure maximum benefit from that investment; and incentives for low carbon buildings can be used in competitive grant programs. Targeted financial incentives; tools and technical assistance; engaging in key initiatives such as the National Energy Efficiency Registry; and leadership and peer to peer networks are additional ways the federal government can enable and accelerate faster building carbon reductions economy wide.**

- Existing Federal funding programs should be leveraged to advance deep efficiency in all sectors and all states.
- Where there are **existing competitive grants for private organizations**, Federal programs can incentivize deeper reductions in carbon and achieving net zero energy or carbon, by awarding more points for applications that commit to higher tiers of performance.
- With the Low Income Housing Tax Credit (LIHTC), for example, some states such as Georgia and Colorado require ENERGY STAR or green building certification for funded housing, while

others require little beyond code. S.1703 and **H.R. 3077, the Affordable Housing Credit Improvement Act (AHCIA) of 2019** would expand and strengthen this housing credit, a proven tool. This important expansion and update could be leveraged in such a way to incentivize highly efficient, low carbon construction.

- Any infrastructure package should look for ways to ensure that any construction or renovation is done to maximum energy and water efficiency, take advantage of opportunities to add renewable energy generation and EV charging, and integrate with the power grid and /or district energy systems, where applicable. In addition, infrastructure investments should consider the role of construction phase carbon emissions, including the embodied carbon of materials. Tools to help projects understand these impacts and make informed selections are available and can be more broadly used. A number of these recommendations are included in **H.R.2479, Leading Infrastructure for Tomorrow's America Act (LIFT America Act)**.
- Updating and making permanent key tax incentives such as the **179D Energy Efficient Buildings tax deduction**, which expired in 2017 will help support building owners and investors in retrofitting existing buildings, as well as in constructing new above-code buildings. Importantly this deduction has included performance criteria, incentivizes whole building efficiency, and requires verification.
- For homeowners, the **H.R. 2043: Home Owner Managing Energy Savings (HOMES) Act of 2019** would provide rebates for owner investment in improving efficiency of homes up to 4 units.
- Engaging the private sector in training and developing the workforce of the low carbon economy is another key area. Efforts such as **H.R. 1315: Blue Collar to Green Collar Jobs Development Act of 2019** and Sections 304 and 111 **the Energy Savings and Industrial Competitiveness Act**.
- Funding to increase the number of qualified residential energy efficiency workers to support ENERGY STAR for Homes ratings, in areas with underrepresentation of such qualified services, could be beneficial.
- Supporting improved function of the **financial sector** in recognizing low carbon buildings, which are lower risk. Federal action in this area could include expanding the impact of green mortgage products and reduced mortgage insurance premiums; as well as potentially targeted challenge grants to support private sector efforts to provide useable home energy information to homebuyers. Considering state and local building energy codes, as well as compliance, in establishing risk-based mortgage insurance rates, could be effective.
- Similarly, accounting for energy costs in home lending can help homeowners as well as incentivize efficiency investment in home sellers, such as provided in the **SAVE Act provisions in H.R. 3962, Energy Savings and Industrial Competitiveness Act of 2019**.

Thank you for the opportunity to provide information to the Subcommittee on this important topic.

About USGBC

USGBC is a nonprofit organization dedicated to transforming the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and prosperous world. We are best known for our successful Leadership in Energy & Environmental Design (LEED) green building certification system. In addition to LEED, we leverage our education, credentials, events, communications, and policy advocacy activities to drive sustainable and high performing buildings, campuses, and communities that improve the quality of life for all. Through these programs, we support building owners, operators, and tenants from the private and public sectors in meeting their goals

for spaces that save energy and water, support occupant health and productivity, reduce impacts on the climate, and incorporate resilience.

USGBC has more than 9,000 business, organizational, and government members, and many additional individual members. Our business membership includes the full range of the building sector, including builders of all sizes, product manufacturers, professional firms, and real estate owners and firms, as well as health care, major retail corporations, hospitality, financial services and insurance companies. More than 200,000 individuals around the globe have LEED credentials including LEED AP and Green Associate.

About LEED

Since its establishment in 2000, LEED has become the most successful voluntary, consensus-based private market-driven high-performing green building program in the country, with more than 64,000 commercial and institutional projects that have achieved LEED certification and another 49,000 projects underway. In addition, there are more than 394,000 residential units currently certified and many more registered.³ LEED has bolstered the U.S. construction sector and created new industries that have converged into a multibillion dollar domestic high-performing building industry.

LEED gives building owners and operators the tools they need to have a measurable effect on their buildings' performance, with a whole building, life cycle approach driving achievement of sustained savings. LEED works by establishing prerequisites and optional credits in key categories including integrative process, location and transportation, sustainable sites, water, energy, materials and resources, and Indoor environmental quality, as well as rewarding innovative strategies and attention to priority regional issues. Achieving LEED certification requires satisfying all prerequisites and earning a minimum number of credits. The levels of certification reflect the number of points earned: Certified (40–49 points), Silver (50–59 points), Gold (60–79 points), and Platinum (80+ points).

To reflect building industry best practices, LEED is updated following processes that ensure the highest levels of openness, inclusion and transparency. LEED committees are populated by a diverse group of technical and market experts who donate their time and expertise to advance the system.

LEED is designed to address the unique needs and challenges of a variety of different building and space types. It currently includes 21 different market sector adaptations. Projects such as warehouses and distribution centers, data centers, laboratories, hotels and motels, existing retail, existing schools, existing multifamily, and mid-rise residential buildings are specifically addressed within LEED. The LEED rating system addresses new construction and major renovation, and existing buildings. Because optimizing operations on an ongoing basis is critical to achieve savings and benefits, projects are encouraged to recertify periodically; USGBC has invested in systems to support and streamline recertification.

LEED seeks to engage building projects with industry best practices and deliver superior outcomes for the built environment. LEED's flexible, credit-based structure allows project teams to pursue a tailored benefit package that best suits the project's location, climate zone, building type, budget, and market positioning; while minimum prerequisites across all categories assure threshold performance. Third-party review and verification offer accountability and transparency for performance outcomes.

Complementing LEED, we recently introduced LEED Zero certifications, which recognize buildings that have achieved net zero carbon, net zero energy, net zero water, or net zero waste. LEED Zero is a performance-based certification indicating the achievement of net zero in operations over a 12-month period.

³ USGBC data, as of May 2019. The commercial and institutional category includes all non-residential building types and some mixed use and high rise residential.

Business Case

LEED has transformed how the building industry and the public consider sustainability in real estate. The private sector has embraced LEED in recognition of the strong business case for green building. It has been demonstrated through many studies that green buildings can save money on a life cycle basis, as energy and water savings pay back quickly and add value. Beyond these direct utility savings, studies have documented a number of financial benefits for businesses, and supported the proposition that LEED-certified buildings with lower operating costs and better indoor environmental quality are more attractive to many corporate, public and individual buyers.

Businesses understand that their biggest investment is in the human resources that work in those buildings. By providing spaces that are comfortable, high air quality that allows focus and high cognitive function, and features such as daylight and ample ventilation, employees are poised to be more productive and healthier than those working in conventional buildings. High quality, health-supporting buildings help attract talent as well; since we spend about 90 percent of our time indoors, people naturally want to feel confident interior spaces are good for them. These considerations can translate into increased sales and rent prices and improved lease-up rates for green buildings.

For example, in one Department of Energy (DOE) funded study, a researcher from the Wharton School reviewed over 50 studies examining the impact of energy efficiency and green labeling on building valuation and completed a "metastudy" of the literature.⁴ The report provides evidence of substantial price and rent premiums that are associated with sustainable buildings in the commercial sector. The team reviewed studies that investigate the impact of certifications such as LEED and ENERGY STAR using state of the art methodologies, based on econometrics, combined with current real estate industry data to identify the relationships between green building practices and value. On average, these econometric studies establish value premiums of 6% for rents and 15% for prices for buildings with LEED and Energy Star labels. The research found evidence of multiple economic benefits of LEED and ENERGY STAR, such as improvement in net operating income (NOI) by both (1) reducing energy costs (which represent 25% of the operating expenses) and (2) increasing rents by reducing vacancy and by increasing a tenant's willingness to pay higher rents due to a higher worker productivity and a desire for "green" space and the reputational advantages; and a decrease in the Cap Rate, indicative of lower risk.

Another study of some 26,000 office buildings, found that certified office buildings, on average, continue to have higher rental, occupancy and pricing levels.⁵

Resilience

High-performing, efficient sustainable buildings are the first step towards resiliency, since they require less energy and water to maintain operations, and reduce stress on local grids and water infrastructure. LEED projects are rewarded for incorporating such resiliency-supporting features as the use of durable materials, careful site selection, rainwater collection, demand response, grid islanding, maximal energy efficiency, on-site renewable energy generation, and more. These approaches can help not only LEED buildings become more resilient, but also their surrounding communities.

⁴ Susan Wachter, Valuing Energy Efficient Buildings (2013), supported by the Consortium for Building Energy Innovation (CBEI) sponsored by the U.S. Department of Energy, <http://cbei.psu.edu/wp-content/uploads/2016/07/Valuing-Energy-Efficient-Buildings.pdf>

⁵ Nils Kok and Rogier Holtermans, of the University of Southern California: "On the Value of Environmental Certification in the Commercial Real Estate Market (date) <https://lusk.usc.edu/research/working-papers/value-environmental-certification-commercial-real-estate-market>

A 2018 study by the University of Texas at San Antonio focused on how LEED v4: New Construction specifically addresses building resilience.⁶ The study, presented at the National Institute for Building Sciences (NIBS) Building Innovation Conference, identified 14 types of natural disasters relevant to the built environment, and then analyzed how LEED v4 credit requirements enhance building resilience against these adversities. The study concluded that LEED v4 credits and prerequisites provide a multitude of opportunities to enhance resilience. Specifically, the study found that 64.8% of all credits contribute to increased resilience against flooding, and 63% of credits enhance resilience to hurricanes or typhoons.

Examples of LEED certified projects that have demonstrated exceptional resilience qualities include an interior office space in San Juan, Puerto Rico that survived and thrived in the aftermath of a hurricane; an apartment building designed to rehabilitate and support formerly homeless veterans; and a large corporate headquarters building designed to withstand hurricane-strength winds.

To further support project teams in enhancing resilience, USGBC now offers a resilience-focused rating system, RELi, as well as several resilient design pilot credits in the LEED system. The RELi rating system, originally developed by the Institute for Market Transformation to Sustainability, aligns with LEED, while expanding the focus on proven strategies and methods. For example, RELi requires assessment and planning for acute hazards, preparedness to mitigate against them, and designing and constructing for passive survivability.

USGBC partnered with the Institute to synthesize LEED resilient design pilot credits with RELi's Hazard Mitigation and Adaptation credits, thereby strengthening the alignment and compatibility of LEED and RELi for projects. The LEED resilient design pilot credits are currently available to all new construction projects. The credits include *Assessment and Planning for Resilience*; *Design for Enhanced Resilience*; and *Passive Survivability and Back-up Power During Disruptions*.

Building resiliently – and building back “better” – deliver significant financial benefits, as well as protecting life and property. A 2019 study by the National Institute of Building Sciences (NIBS) found that each \$1 spent on mitigation activities saves between \$4 and \$11 in response and recovery costs.⁷ By incorporating resilient strategies, especially via LEED certification, projects are more sustainable, durable, healthier, and better for the overall community

Exports

Global markets see growth for high performing, energy efficient buildings and the products and services that support their development and operation. Goods and services touching on clean energy, energy efficiency, resilience and increasingly, buildings and infrastructure related IT and data, are a growing area of the U.S. economy. These sectors provide an already impressive number of jobs for U.S. citizens including many high quality manufacturing and construction jobs. According to the IEA, the global market for energy efficiency in buildings grew by 9% from 2014 to 2015 to \$388 billion.⁸ A 2016 study found that global green building continues to double every three years.⁹

Private and public sector support for energy efficiency and sustainability within the U.S. has enabled a thriving industry, in turn creating a huge export market for U.S. made building products and services. The U.S. Department of Commerce projected a \$39 billion export market for the building sector in 2018, with

⁶ Sandeep Langar, Ph. D., and Suchismita Bhattacharjee, Ph. D., [Focus of resilience within Building Rating Systems \(BRS\) LEED 4.0 Review](#), presented at Building Innovation 2018 (January 9, 2018).

⁷ National Institute of Building Science, [Natural Hazard Mitigation Saves: 2018 Interim Report](#).

⁸ International Energy Agency (IEA), Energy Efficiency Market Report 2016.

⁹ Dodge Data & Analytics, SmartMarket Report: World Green Building Trends 2016: Developing Markets Accelerate Global Green Growth (2016).

focus on sustainable, energy efficient goods and services.¹⁰ Commerce identifies the global demand for sustainable construction as a major driver for the demand for US products and services; with China number 3 in importing American building products.

This strong export market for products such as wood products, windows and doors, insulation, HVAC, insulation, plumbing and glass all increase good jobs here in the U.S. As Commerce observes, with increased global interest in smart, resilient, and efficient buildings, "U.S. building products are competitive... U.S. manufacturers have much to offer global markets that recognize increasing building performance."¹¹

¹⁰ U.S. Department of Commerce, International Trade Administration, 2016 Top Markets Report: Building Products and Sustainable Construction, A Market Assessment Tool for U.S. Exporters (2016).

¹¹ *Id.*

Mr. RUSH. I want to thank all the witnesses. We have now concluded opening statements, and we will now move to Member questions. Each Member will have 5 minutes to ask questions of our witnesses, and I will start by recognizing myself for 5 minutes.

Mr. Keane, I want to thank you for your willingness here this morning, and I appreciate your willingness to work with my office to hold an energy efficiency job readiness fair early next year in my district. My office will followup with you to confirm the logistics. We are eager to work with Local 17 chapter of the insulators to provide you with hardworking, qualified candidates to help swell the ranks of your union.

My office, Mr. Keane, received information regarding some of the programs that you conduct in my district, including the Same for all Community Development Program, the South Suburban Highway to Construction Career Program, and the Chicago Women in Trades Program.

Can you briefly summarize what each of these programs do and how an interested candidate may enlist in each of these programs and the impact of each of these programs on energy efficiency?

Mr. KEANE. Thank you for the question, Mr. Chairman.

When we go to these different sectors when we are doing our reach out, OK, it is an umbrella. We try to hit as many places as we can to make sure that we reach out to all communities.

With the Women Build Nations, that is a big movement for our ladies in the trades to express how being a tradeswoman is. As far as the reachouts to the different communities and the different groups with Mrs. Ford, we want the communities to know that we are there, that we are there for their people that we offer not just jobs.

We offer careers. And we want to really, really bring it home with our people all across the board, especially in Illinois, in—Chairman Rush, in your district. We want to reach out to the people. We want them to learn as they earn with an apprenticeship.

And the big thing is, after their 5-year apprenticeship, they were paid to learn for 5 years. And now they are going into the job market with not just a job, Mr. Chairman, but a career.

Mr. RUSH. I want to thank you very much.

Mr. Elefante, my offices will be partnering with the National Laboratories, coupled with NSN and the Illinois Institute of Technology, another organization in one of the poorest neighbors in my city in the Englewood community to develop affordable energy-efficient housing that can be used as a national model.

I would like to followup with your organization, the AIA, to work with these housing developments that will consist of some of the most innovative energy efficiency designs possible. We would like to work with you if I can followup with you and get your organization to work with us. Would that be something that you would be interested in?

Mr. ELEFANTE. Absolutely, Mr. Chairman. Thank you for the question.

Housing design has always, of course, been a really important part of what we do. If you look at the statistics of the building stock, housing is, you know, an enormous part of it, 325 billion square feet of building in the United States of America.

About 2 billion square feet of that is single-family residential. The remaining 130-plus billion square feet is somewhat equally divided between multifamily housing, commercial, and institutional buildings. So each one of them is an enormous sector.

Our work with affordable housing has shown that housing affordability and energy efficiency are not oxymorons that don't go together. But actually both can be achieved together. So we would be happy to work with you to really demonstrate that affordability and energy efficiency support each other.

The last thing I will say on it is to just simply say that one of the things that I can say from my own work in the State of Michigan, for example, is that you end up with an affordable housing unit that then has very low utility bills, in the nature of something like 20 percent. And that is a gift that keeps on giving.

Mr. RUSH. The Chair is out of time.

The Chair now recognizes Mr. Upton for 5 minutes for the purposes of questioning.

Mr. UPTON. Thank you, Mr. Chairman, I know that we are going to be pressed for time because of the votes that are going to occur shortly, so let me just yield the first part of my time Mr. Griffith from Virginia for—

Mr. GRIFFITH. Thank you very much. I appreciate you yielding.

As many of you may have seen yesterday, led by some Cornell Lab ornithology scientists, a report came out that the breeding population of birds in the U.S. and Canada has dropped nearly 30 percent since 1970.

The good news is, as we are making buildings more efficient, and particularly when we are dealing with glass, we can make bird-safe buildings as well. Nearly a billion birds—estimates range from anywhere from 100 million, 640 million to a billion birds a year—collide with buildings and die.

Accordingly, I would ask—instead of going through all the testimony, I would ask that we have unanimous consent to submit reports on how we can have both energy-efficient and bird-safe buildings. And I would mention that the American Bird Conservancy has shouted out yesterday that one of the ways to solve the problem is a bill that Mr. Quigley and I have introduced. And Mr. Welch and I are currently working on an amendment to his energy bill that would incorporate some of this language.

Mr. RUSH. Hearing no objections, so ordered.¹

Mr. GRIFFITH. And I yield back.

Mr. UPTON. Thank you, my friend.

Mr. McIntyre, State and local governments do, as we know, play a very key role in the codes adoption process. And I believe that it ought to stay that way because State and local governments have a better handle on how nationally developed codes are going to work in practice, particularly as you look at north, south, east, and west.

Why is it so important to tailor codes to local conditions, local market forces, and consumer demands?

Mr. MCINTYRE. Well, first—

¹The information has been retained in committee files and also is available at <http://docs.house.gov/meetings/IF/IF03/20190920/109973/HHRG-116-IF03-20190920-SD010.pdf>.

Mr. UPTON. Versus a one-size-fits-all?

Mr. MCINTYRE. First and foremost, our code process now is a consensus code process, and it is a vigorous, consensus driven—it is input from industry, input from code officials, input from builders, input from associations. So it is driven by consensus. Then that drafts the overall code or the national code that then can go to the States, that the States can adopt to their choosing. They can modify it for local conditions. They can adjust it for local conditions. They can adopt it statewide, as in the case of Michigan with modifications for the State of Michigan, which are important to meet the needs of the consumer and the market in our State. States also have the choice, if they want, to add to that code, if they choose, as other States have.

So having that flexibility as builders, the market, markets are not the same across the country. They are not the same within a State. Having the ability to adopt the code—and this is the code officials in the industry that are—consensus that are doing this at the State level, is very critical to have that flexibility to deliver the product that the consumer is demanding. That is the key. The consumer, if we want this to scale, the key is developing a product, a house is a product, developing a product that the consumer wants in the area that the consumer wants it, and deliver that product to them cost effectively, and it will go to scale. Having the ability to adopt local codes or adjust to local codes is important for that reason.

Mr. UPTON. So as we all think about energy conservation, how valuable would it—or is it done very much now where a new buyer sitting down with a builder to actually see an audit as to what the energy efficiency will be for that home, whether it be glass, heating and cooling, water, electrical use, based on the size of the—

Mr. MCINTYRE. Yes, you are referring to an energy audit?

Mr. UPTON. Right.

Mr. MCINTYRE. Part of the value that we need, that the consumer needs to realize, they have to see and realize what they are going to get.

Mr. UPTON. But is that done now?

Mr. MCINTYRE. It is starting to be done. We do it. The folks that are building high-performance homes are doing it. We are doing it voluntarily. We have a history of the houses we built. We have built hundreds of houses that are high-forming homes. Low HERS, ENERGY STAR, Energy Value Housing houses, we have a record of what it costs to build them, what it costs to—how they perform and to live in. And we can start showing that to consumers, and then we can model, through software, what the performance of their projected home is and give them that, I will say, comfort level of how their house is going to perform.

When a consumer comes through the door, 10 years ago—don't ask me why that is going off.

Mr. UPTON. Hopefully it is your wife.

Mr. MCINTYRE. Shut off.

Geez.

Mr. UPTON. It is a robocall, but we are going to stop those. We passed a bill to get that done.

Mr. MCINTYRE. When a consumer comes through the door, 10 years ago, they weren't looking for energy efficiency. Today, when they come through our door, they are looking for it, because they know we have the ability to deliver that value. And that is what they ask for. So we show them that. We show them some history, and then we're on our way to going down that road with them.

Mr. UPTON. My time is expired.

I yield back.

Mr. RUSH. The Chair now recognizes Mr. Pallone, the chairman of the full committee, for 5 minutes for the purposes of an opening statement—questions.

Mr. PALLONE. Thank you, Chairman Rush.

Our witnesses today have testified that more than half of the residential and commercial buildings that will be standing in 2050 have already been built. And as we look for ways to achieve net-zero emissions by that year, we will have to find effective ways to eliminate emissions from these existing buildings. I am actually glad they will still be standing. I like old buildings. I don't want to knock them down.

But my first question will be for either Mr. Nadel or Ms. Beardsley or Mr. Elefante. We know that efficiency can go a long way in decarbonizing existing buildings, but we need to do more than just maximize efficiency. So just talk to us about some policy levers we can pull today to reduce or eliminate emissions from buildings beyond just improving the energy efficiency.

And I will start with Mr. Nadel, if we could.

Mr. NADEL. Yes, there are a variety of policies that can be pursued, and in particular, let me pick up on something that Mr. Upton was asking about. Do we provide information to home buyers on the energy efficiency of homes before they buy it? For example, the city of Portland, Oregon, requires that when you put a home on the market, you provide a 1 to 10 rating. It is called the Home Energy Score. It is information that the homeowner can consider as they buy the home, and particularly since so many homeowners improve their homes right after buying it. It can be a powerful incentive. So that would be one thing.

We do endorse the HOMES Act that Representatives McKinley and Welch have introduced. How do we encourage people to make those improvements? Likewise, improving—increasing the Weatherization Assistance Program, particularly for low-moderate income families, as well as in tax incentives. But let me—

Mr. PALLONE. Well, Mr. Beardsley, I guess—or Ms. Beardsley. I am sorry.

Ms. BEARDSLEY. Thank you, Chairman.

It is a great question because we talk a lot about energy efficiency, and that is the core, but actually there are a lot of other pieces to a high-performing green building that can contribute to reducing emissions and reducing their energy use.

So if you think about water, so if we are connected to a public water system, that takes energy to withdraw that water, to treat it, to pump it to your house or your building. So if you are conserving water in your building, that is also reducing energy of the system at large. Similarly, if you are using a landscape that is lower-water using or you are using rain barrels or cisterns or other

methods that are less needing, potable water, that also reduces that energy.

And then on the material side, there are lots of choices and innovation. This is a great area for the U.S. economy to move ahead in different material options. And even with green building, there is an intent to try to reduce construction waste. So buildings are planned and built in such a way that there is reduced waste and it is often reused in other ways or recycled for other products down the road, rather than going to a landfill or incinerator, and these all contribute to reducing emissions.

Thank you.

Mr. PALLONE. All right. Thank you.

Mr. Elefante?

Mr. ELEFANTE. Thank you. I would just like to build on both of those comments. First, to the benchmarking, the value of data in this. And I would just remind everybody the importance of the U.S. Energy Information Agency's database. Everything that we do from any kind of a policy or program point of view, we have to go back and really look at the data, understand what the impact is. The importance of the work of that agency I just wanted to underscore. We really need that data to understand what our practices need to be.

And then just related to what Ms. Beardsley just said about these other factors, I would just sort of put it out there to be thinking about the associated benefits of energy efficiency, and I particularly point to health benefits. We went to a global energy efficiency conference last year, and really that was the nature of that conversation.

And I would just kind of remind everybody that thinking about these associated benefits to the kind of central goals here are actually the kind of win-win that really helps drive the market and really helps articulate the value of these energy-efficient goals that we are seeking.

Mr. PALLONE. All right. Thank you.

Thank you, Mr. Chairman.

Mr. RUSH. The Chair now recognizes Mr. Latta for questioning.

Mr. LATTA. Well, thank you, Mr. Chairman. And thanks to our witnesses for appearing before us today.

Through this hearing today, it is my desire that we will continue to focus on improving energy efficiency, which should be a bipartisan issue. One of the most successful programs for promoting energy efficiency and benefit customers, manufacturers, and the environment is the ENERGY STAR program. The ENERGY STAR program is a voluntary program run by the Environmental Protection Agency and the Department of Energy. It allows manufacturers to obtain ENERGY STAR labeling for products. Its specific energy savings guidelines are met, benefiting consumers that are looking to purchase high-efficiency energy products.

I believe that one way we can improve the energy efficiency in the building sector is to strengthen this important program. That is why I introduced the bipartisan H.R. 2104, the Energy Star Program Integrity Act, along with my good friend, the gentleman from Vermont. This bill fixes a gap in the Federal law by prohibiting the pursuit of private litigation against manufacturers who comply

with corrective compliance measures that were approved by the EPA. This will ensure the ENERGY STAR program will operate as intended by maintaining robust, voluntary participation by the manufacturers.

If I could start my questioning with you, Dr. Zimmermann, and also, I do have a BASF plant in my district in Whitehouse, Ohio, and which I have visited on many occasions. And it is my understanding that BASF Corporation has sought out the ENERGY STAR label for many of its products. Would you go into some detail about these products and how they help create more energy-efficient homes and buildings?

Dr. ZIMMERMANN. Thank you for the question, Mr. Congressman. BASF has a variety of products right now that do enhance energy efficiency, such as spray polyurethane foam, which is a very good example of that. These products bring not only reduced energy utilization, but they also provide resilience as well through water barrier protection and also barrier wrap protection. These are very good products.

Other products we have like our Green Sense Concrete, these are not just product names; it is more of a philosophy around developing cement formulations that can really utilize local ingredients that reduce the carbon footprint so they are used in place. A great example of that is Portland cement can be replaced with recyclable material, locally found material, again, leading to a reduced carbon footprint in the application of those materials.

A variety of other products, again, from an ENERGY STAR perspective, you know, greatly reduce the energy of manufacturing, the carbon footprint, the greenhouse gas emissions during both manufacturing and use as well.

Mr. LATTA. So it is very important for your company to participate in the ENERGY STAR program?

Dr. ZIMMERMANN. It is very important, and also, we utilize our own products in our own facilities to ensure that they are running energy efficient.

Mr. LATTA. Do you think there is a merit in strengthening the voluntary programs like ENERGY STAR so that more companies can continue to innovate with energy-efficient products?

Dr. ZIMMERMANN. Companies like BASF will continue to innovate products for more energy efficiency because we have incentive to do that. We certainly don't want to waste energy, because it costs money. I think strengthening the program that allows for more voluntary adoption would be very good for manufacturers.

Mr. LATTA. Thank you.

Mr. McIntyre, let me turn my questions, if I may. In your testimony, you specifically cite the ENERGY STAR program is a successful program with a proven track record in reducing energy usage in part due to its voluntary nature. Would you explain to us why this program is so popular in the homebuilding industry?

Mr. MCINTYRE. Well, the ENERGY STAR program is one of several, and it is—I will say it is somewhat the pinnacle of a high-performance home. That can be argued to a degree, but the point is, when a consumer comes through your door, they are—for the most part, they want a performing home. They don't know what that means necessarily. You have got to explain that to them to a

degree. And you have a HERS-rated home. You have an ENERGY STAR home. You have green homes that you can do.

We spend the time to go through and explain to them what the difference in performance is and how you get there, the system's approach, how you address the envelope, how you address the air sealant, how you address mechanical systems. Then we give them the option. We tell them we HERS rate every home. HERS rating is an energy rating. It is a miles-per-gallon sticker for your home. We tell them we rate every home. Here is where our homes generally score. That starts to give them the feel that, OK, the confidence. We show them some of the energy simulations, if they want to get to that level of detail. And then we offer to certify the home for ENERGY STAR, and we also offer green building programs if they want.

And about 25 to maybe 30 percent of our customers will want to go for the ENERGY STAR certification. Right now, we are a small homebuilder. We used to be a lot bigger, but we scaled back at the recession and kind of like it that way now, but—right now, we have one ENERGY STAR home in certification, two of them in process. That is probably the max we would have at any one time being built, but we leave it up to the consumer to make that choice.

Mr. RUSH. Mr. McIntyre, will you bring your comments to a close?

Mr. LATTA. Thank you very much to the witness.

And, Mr. Chairman, my time is expired. And I yield back.

Mr. RUSH. I want to thank the gentleman.

I want to remind Members that between 10:15 and 10:30, there are votes expected on the floor.

So, with that, I want to recognize now Mr. McNerney for 5 minutes for questioning.

Mr. MCNERNEY. I thank the chairman. I thank the witnesses this morning. Very interesting testimony.

So let's take a hypothetical 50-year-old home somewhere on the coast of California, maybe 2,000 square foot. What is the payback time for retrofitting that for energy efficiency?

Ms. Beardsley, if you would like to take that.

Ms. BEARDSLEY. Thank you for the question. It really depends on, you know, what the fuel rates are, what fuel they are currently using, what the options are in that. But generally, the paybacks, as we have seen in some of these studies, can be very small. You know, it could be a couple of years to maybe 7 to 10 years, but I can answer in detail on the record.

Mr. MCNERNEY. Mr. McIntyre, it looks like you want to say something.

Mr. MCINTYRE. No, I just wondered if that was a general question or—I concur to a degree of what Ms. Beardsley just said. It depends on what you are doing to it, the types of retrofits you are doing and how far you are going with it. But what is important, that is a key piece to the value that we talked about. As consumers start to see that return, whether it is in their energy bills or whether it is in their gas bills or electric bills, they start to see that return, that value, then they start incurring more—they will pay more. They will do more as they see that value.

And it is a key to get them to understand that. Once you get the market to start understanding that, they know there is true payback there, then the market will take over and start driving it, which it is starting to do.

Mr. MCNERNEY. So, Mr. Nadel, could you give me some idea of how much regional variation there would be in that answer? You know, is there a huge difference between, say, Michigan and California in terms of payback?

Mr. NADEL. There definitely will be regional variation. Paybacks tend to be quicker in colder climates like Michigan. California is a very diverse State, where you are talking the Sierras or you are talking, you know, the desert, but it will vary. On the other hand, in California, they use a lot less—they use a lot less energy to begin with.

Mr. MCNERNEY. Thank you.

Again, Mr. Nadel, can time-shifting of energy requirements for homes be realistic, say, to sync better with renewable energy?

Mr. NADEL. Definitely there are opportunities to shift the time that energy is used, particularly, you know, if you add a little thermal mass to the home or include a modest amount of storage. California, as I am sure you well know, is moving to time-of-use rates, and we expect a lot more of that happening in California.

Mr. MCNERNEY. Well, one of the frequently cited concerns with regard to electrification is the operating costs. Is there a way to restructure utility billing to sort of levelize that problem?

Mr. NADEL. I mean, I think the general trend is to have time-of-use rates so that the rate varies, depending on the cost to produce. But then as you are designing the retrofits, as you are doing electrification, you need to add a little bit of storage and think about it; how can you do more of your heating and cooling during those off-peak times and glide through the times when the period is high? And, yes, that can be done.

Mr. MCNERNEY. All right. In the interest of time, I am going to yield back early, Mr. Chairman.

Mr. RUSH. The Chair thanks the gentleman.

The Chair now recognizes Mrs. McMorris Rodgers for 5 minutes.

Mrs. RODGERS. Thank you, Mr. Chairman.

As many of you know, I am proud of how eastern Washington has been leading the country in clean energy solutions such as clean, renewable, reliable, affordable hydropower. As we discuss ways to increase building efficiency, I also wanted to highlight a way that we are leading, and that is cross-laminated timber. CLT is strong, sustainable, and a renewable low-carbon building material, and it has the potential to significantly increase the energy efficiency of buildings.

There are two CLT manufacturers in the United States and they are both right now in eastern Washington. Vaagen Timbers in Colville and Katerra in Spokane Valley. In Spokane, Avista Utilities is working to develop an eco district center in our community that will be—that will include one of the most sustainable buildings in the country using cross-laminated timber. And later on today, Katerra is unveiling its new state-of-the-art factory, which will produce the highest volume of CLT in North America.

These eastern Washington companies are on the cutting edge of building a more efficient and sustainable future. I am excited about what the potential of new and innovative building materials and processes such as CLT have: economic growth for rural communities, a cleaner environment, stronger buildings, and better forest management.

So it really is—it is a rural job solution. It is a timber solution, but it is also better forest management solution, but it also is part of the carbon solution.

Mr. Elefante, do you agree that the properties of CLT mainly in strength, flexibility, sustainability, and ability to sequester carbon make it an ideal material to build more energy-efficient midlevel buildings?

Mr. ELEFANTE. So I think that the most important thing about CLTs is they indicate what an innovative future would look like where we consider carbon sequestration as one of the factors. I talked about the four things that we in the building sector understand that we must do. One of them is essentially embodied carbon which, you know, the CLT technology is a terrific example of not just looking for products that are more energy efficient, but actually have this additional benefit of actually sequestering carbon in the actual material itself. There is a lot of innovation happening in that area. I would say that at this point, the CLT technology is kind of the poster child of just how many layers of benefit can come from looking at that sort of innovation.

Mrs. RODGERS. Thank you.

I wanted to move on to another important issue in eastern Washington, and that is housing affordability. Like many areas in the country, we are experiencing a serious crisis in affordable housing. We have consistently heard about the desire to mandate net-zero buildings across the country. I have concerns about how this is going to impact housing costs and how it might only add to the current affordability crisis that we are in. It is going to be difficult for me to support any legislation that would make it more difficult to find affordable housing as a result of additional government mandates.

Mr. McIntyre, given your experience building green homes, how much more would it cost to go to net zero?

Mr. MCINTYRE. Well, one of the key items with net zero, the first thing to get to net zero is you got to optimize the envelope. You got to reduce your load. That is done a number of ways. It is done by the shape of the structure, the configuration of the structure. It doesn't matter how you build it or what you build it out of; it is just a simple shape. And then it is the materials you build it out of to reduce the load. But I think it is a pretty fair statement to say that to get to net zero, it is going to require renewables or something to that effect, and that is where the additional cost really comes in at this point.

To get to an optimized home from, I will say, a standard-built home, you are talking a few thousand dollars, \$5,000 to \$15,000, in that range. It could be as high as 20. When you go to net zero, now we are looking at renewables of some sort.

I personally just put in a 12-kilowatt system on our farm, and I did that work all myself, and I did it because it makes sense now

because we have net metering. There are tax incentives. And the cost of solars come down because it is scaled much more than it was 15, 20 years ago.

So now that they are more affordable, it makes sense to do, but they were still \$18,000 for me and I installed all of it. Actually, it was more like \$20,000, and I installed it all. That system quoted to me was about 40,000.

So the difference in cost really starts coming in the PV. That is where getting to scale, getting that consumer recognition, which is solar—we are starting to see we have net metering in Michigan—and now we are seeing solar panels pop up, small panels all over in yards and homesteads around Michigan.

Mrs. RODGERS. Thank you.

Mr. RUSH. The Chair now recognizes Mr. Loeb sack for 5 minutes.

Mr. LOEBSACK. Thank you, Chairman Rush, Ranking Member Upton. And thank you to the witnesses for being here today as well. It has been a great discussion. I personally want to thank my friend, Mr. Tonko, for letting me go ahead of him.

Thank you so much, Paul.

When it comes to tackling the climate crisis, we must be committed to finding solutions that reduce emissions now and that grow our economy and create new jobs in our communities, and I think any investments in infrastructure across the country must drive down the costs. For Iowans, where I am from, particularly those in the rural communities, promote the production and expansion of renewable energy sources and create jobs.

I want to shift the focus a little bit to schools, if I could. Today, we are specifically looking at ways to reduce emissions and improve energy efficiency in the U.S. building sector, but I recently introduced legislation to help achieve this goal in our Nation's school buildings. This is the Renew America's Schools Act. This bill, which has been included in the LIFT America infrastructure proposal, would award \$100 million over the course of 5 years to help schools modernize and make critical energy-efficient upgrades to their facilities. And to add to that, the legislation also sets aside a percentage of funding to be used for educational programming for students around the efficiency upgrades so they know what this all means for them and for future generations. And they can take that home to their parents as well, by the way. I think that is a part of this that is really important.

This is a win-win for workers, students, and parents that will help create jobs, reduce emissions, and produce long-term cost savings for our schools due to increased energy efficiency, all while providing our students with topnotch learning environments and educating them about the importance of clean and efficient energy technologies.

We know that the environment in which our students learn and educators teach can have an immense impact on the quality of education our children receive. My wife was a second grade teacher for over 30 years. So she is very aware of that. And, unfortunately, many of our Nation's schools are in a really sad state of disrepair, as I think everyone here knows.

First, I would like to go to Ms. Beardsley for a couple of questions. In your testimony, you highlighted some of the advances

being made both in new and existing school facilities. First question: Can you elaborate on what you think are the most effective upgrades that existing schools can make to their facilities in order to significantly reduce emissions and improve their efficiency in the short term?

Ms. BEARDSLEY. Thank you, and I really appreciate your sponsoring the schools bill. That is really important.

With existing schools, it is much like other existing buildings. So the basics are improving the envelope and upgrading the HVAC systems, the lighting. But, you know, with schools, as you alluded to, with students, there is so much research. Our Center for Green Schools has collected much of this. We have done a State of Our Schools report a few years ago, showing the State of the Nation's schools and the need for this reinvestment in school infrastructure.

We know that students learn best when the indoor environmental quality is very high, so CO2 levels and oxygen, and also when there is daylight and there is connection with nature. So schools are a really special environment, and they are really important to not just the students, but the whole community. So there is really a lot that can be done there to increase efficiency, use it as a living laboratory, and really help that connect with the community's schools.

Mr. LOEBSACK. Thank you. You have kind of answered the second question, but you might want to add a little bit to that. What are some of the most significant cobenefits that you expect to see when schools make improvements to their facilities outside of reduced emission and lower energy costs?

Ms. BEARDSLEY. Right. So we would see, with the indoor improved air quality, there would be improved conditions for student learning. You may have better wellness, so reduced sick days, and that includes the teachers as well, the staff. And really, like having that benefit of increased connection with nature and daylight, which has been proven to support learning.

Mr. LOEBSACK. Thank you.

I do love going to brand-new schools that incorporate a lot of the technologies we are talking about today, but I really would like to see more of the older schools be able to do exactly the same things and be upgraded.

Mr. Chairman, in schools throughout the country, buildings often lack proper heating, ventilation, and air-conditioning systems. Energy costs for K-12 schools total approximately \$8 billion annually nationwide, but according to the EPA, 2 billion of those dollars can be saved by improving energy efficiency. This cost is equivalent to about 40 million new textbooks or hiring an additional 50,000 teachers at current salaries. We need to think about the opportunity costs there.

So, thank you very much, Mr. Chair and Mr. Upton, for having this hearing, and thanks to the witnesses. And in particular, I want to thank my colleague, Mr. Tonko, for letting me go before him.

Mr. RUSH. The Chair thanks the gentleman.

The Chair now recognizes my friend from West Virginia, Mr. McKinley, for 5 minutes.

Mr. MCKINLEY. Thank you, Mr. Chairman.

Look, as a professional engineer, I have probably spent 50 years, nearly 50 years in the construction sector specifying a lot of low energy—low use—low-energy use and high-efficiency building. In fact, my company, about 15, 20 years ago, we were some of the first designing LEED-certified buildings in this country, and certainly in West Virginia. And we have tried to do this, working with my fellow colleague from Vermont, we have been able to try to get some accomplishments in energy efficiency.

And I appreciate, Mr. Nadel, you are underscoring two of our bills that we are working on, and I think that we can advance those. But I guess I don't want it to be a "but" on there, but there is a concern. And, Elizabeth, you were the first—you have mentioned it now for the first time was indoor air quality.

And I have been troubled as an engineer that we tend to ignore that, the impact that indoor air quality is going to have an effect on it, because it is really going to stress our ability to get energy efficient—or, excuse me—energy reductions costs. Because we know that typically a classroom today, it may be, at best, it has one air turnover an hour, maybe at best, but under ASHRAE standards, it wants us to go to anywhere from 4 to 20 air changes an hour.

So we know we are going to be putting a lot more energy into our buildings as a result of that to achieve good indoor air quality so Little Johnny sitting there next to someone sneezing or having some dis—whatever, in the carbon dioxide buildup in that classroom is going to affect his or her health. So I know we are going to have some impact on that.

So I am a little curious about how we might be able to explain to people their energy demands are going to go up because they are currently not meeting good air quality in our classrooms. So I am curious to see how we might be able—so that with full disclosure that people understand their energy costs actually might go up, but their air quality is going to improve and Little Johnny and his sister are going to be healthier when they get out of that classroom.

Can you work with me a little bit on how we might be able to get the public be more aware that we are going to challenge energy for a while?

Ms. BEARDSLEY. Yes. Thanks, Representative. And I do have to mention that I am a frequent visitor to the beautiful Canaan Valley of winter.

Yes, so with schools, again, as with other buildings, what we promote is a whole building approach, and that is really where you can get the most benefit and the most potential cost savings. Even if you improve your air quality with increased mechanical air changes in that example, if you are looking at the whole building and you are upgrading your lighting, say you are going from old incandescent up to LED, you are adding more daylighting with better insulated windows, you are upgrading your HVAC. If you really look at it as a whole systems approach, that is where you can save money even at the same time as you are increasing.

Mr. MCKINLEY. You could I guess, but when you say it can be offset with this air, I think it is important for people to understand we are going to—if we do the proper air changes, we are going to increase at least that component of it. I agree with you on lighting and other elements to it. But I think we need a full disclosure to

make sure people are aware some component might actually increase, but the rest of it we can offset. It is an educational process we have to do with it.

So, Mr. Nadel, in the timeframe that unfortunately we got, one of the most controversial parts we are getting pushback on our legislation has to do with the introduction of the building energy codes. From your perception, what is wrong with the 10-year payback requirement?

Mr. NADEL. I think a 10-year payback is OK, if you have the adequate financing. So, therefore, your loan payments, the extra loan payments are less than the energy savings. In that case, you get immediate positive cash flow. And with mortgage rates today, typically that will be the case.

Mr. MCKINLEY. So would you suggest we should stay the course on this or should we give more flexibility to go beyond 10 years? What do you think we should do?

Mr. NADEL. I think staying the course is good but, yes, maybe some flexibility. Interest rates go up and down. You know, ultimately it should be, if you are going to recommend anything rather than an arbitrary period, talk about immediate positive cash flow and finance with the mortgage act, the then-current mortgage rates, because that is going to be the key.

Mr. MCKINLEY. Thank you, Mr. Nadel.

And just for all of you, I just hope we have more discussion, Mr. Chairman, about indoor air quality, because we think we know. That is an area that we need to pay a lot more attention to.

Thank you. And I yield back my time.

Mr. RUSH. The gentleman yields back.

I want to remind Members that the votes have started, and it is the intention of the Chair to recognize two more Members, Mr. Tonko and Mr. Griffith. And if either one of them want to yield some of their time, then I would certainly be willing to grant that.

But the Chair now recognizes Mr. Tonko for questions.

Mr. TONKO. Thank you, Mr. Chair. And thank you to our witnesses.

Earlier this week, the Environment Subcommittee held a hearing on industrial emissions. I would like to try to explore how these sectors are interconnected, which demonstrates that comprehensive action is necessary to decarbonize our economy.

In many cases, industrial products are difficult to decarbonize, and this includes building and construction materials like cement and steel. Unlike operational emissions, embodied carbon emissions in buildings are locked in place from day one. They cannot be reduced through retrofits or new energy-efficient technologies.

So, Mr. Elefante, do you have any thoughts on the challenges with embodied carbon?

Mr. ELEFANTE. We don't have nearly enough time. This is clearly, I would say, the challenge of 2019, to kind of get our arms around what is an emerging challenge. There is actually a lot of work. We have a summit coming up next week on this to get building product manufacturers, contractors, and architects and engineers together to essentially lay out the problem. That is how early we are in this.

But I would also just point to actually some really exciting work that is being done across many sectors—the CLTs were mentioned earlier—to really address this. And I would just kind of add one thought to this, which is that we have to be thinking about embodied carbon as something looking forward. You know, what is the carbon that we are going to spend from this time forward rather than the carbon that we spent looking backwards?

And when you do that, it sort of changes the lens on embodied carbon, and the importance of material product manufacturer and construction techniques as investments into energy savings, then becomes the kind of formula. How much carbon are you spending to create that efficiency? How long does it take you to capture that efficiency back? A 2050 timeframe is probably long enough for us to be talking about a formula that works.

Mr. TONKO. Thank you. And how can we encourage lower carbon materials are a greater material efficiency for new construction?

Mr. ELEFANTE. There are a lot of ways, but I will point to the one that I think is actually most important, and that is the analogy of the Federal Government and it as a procurer of green building services and green building products. I think that the marketplace transformation that we witnessed was actually begun in the nineties by the Federal Government adopting new standards. And I would just underscore the importance of the Federal purse as a procurer to help transform the marketplace.

Mr. TONKO. Thank you.

And, Ms. Beardsley, what do you think about this whole phenomenon? Does LEED, the LEED incentivize these types of cleaner materials and greater material of efficiency?

Ms. BEARDSLEY. Yes, thank you. This is a great topic and one that is getting a lot more attention. We have been working on it and many of our members for quite a few years, and LEED does incentivize by looking at the—there are credits and points available if you reduce the whole impact of the building, and that includes accounting for key materials.

And we now have the first LEED-certified steel plant, Big River Steel in Arkansas, for example. So that type of facility can look at its own operations and employ energy efficiency to reduce the embodied carbon in its products.

I think there are a few things you can do. You first give industry the tools to use technology to do energy efficiency in the manufacturing plants. Second, R&D to develop new technologies, and that is kind of where the CLT came out of and there is some really cool work at MIT right now on cement. And then, third, encouraging building design and construction teams to evaluate embodied carbon as they are making choices on materials. And the Federal Government as a procurement body, the Buy Clean California Act, there are a number of examples where this is starting to take place.

Mr. TONKO. Thank you. Thank you very much.

We know the impact of buildings on overall emissions, but I would like to focus specifically on direct emissions. Onsite fossil fuel combustion in commercial and residential buildings accounts for some 12 percent of our Nation's greenhouse gas emissions.

Mr. Nadel, what opportunities and challenges do you see for electrification through products like heat pumps?

Mr. NADEL. OK. Yes, heat pumps are dramatically improving. There is a whole new set of cold climate heat pumps. It can work better in places like your district. Still, most of the available systems are ductless systems, but most homes have ducts. I think we need more work on ducted cold climate heat pumps to better adapt to existing homes. And I think the Department of Energy and EPRI are doing a little bit, but much more can and should be done to help refine these systems for existing homes and the ducts they have.

Mr. TONKO. Thank you very much.

Mr. Chair, I yield back.

Mr. RUSH. The Chair now recognizes Mr. Griffith for 5 minutes.

Mr. GRIFFITH. Thank you, Mr. Chairman.

The ranking member earlier yielded to me so that I could talk about bird-safe buildings and how we can do that fairly efficiently while we are making the buildings energy efficient. So I will return the favor for my friend from Michigan to another friend from Michigan, Mr. Walberg,

And I yield to Mr. Walberg.

Mr. WALBERG. I thank the gentleman.

And I appreciate the fact that we have a gentleman from Michigan here today who has extensive experience in what we are talking about, including some—a demonstration home in my district. Worked with the Emory school district, not far from my house, that shows what can be done, but has a reality about it of what it costs.

I represent many areas in my 7th District that are extremely rural, and many of the net-zero technologies we mentioned here today aren't exactly cheap or accessible in Adrian, Michigan, and the surrounding areas. While I am for efficiency, and 19 years ago my wife and I renovated and restored completely our 1837 vintage farmhouse, and at that time, what we did in air-conditioning, heating, electrical systems, water systems, everything about that place was up to date. That is 19 years ago. And so since then, we have been attempting little by little to continue updating to standards, but it takes time, and it is expensive.

So in your testimony, Mr. McIntyre, you mention that net-zero building is extremely difficult, costly, and impractical in many parts of the Nation. Could you elaborate further? Do you have examples why this would be the case in States like Michigan?

Mr. MCINTYRE. Well, a lot of what drives that is the complexity of understanding. When you build a net-zero home or you build a high-performance home—I won't necessarily go to net zero—you build a high-performance home, you need to look at the system of the home. You need to look at—build the house as a system and understand the whole system. So the complexity comes in understanding that.

The unintended consequences are when we don't understand that and we put the wrong parts together, we put them together the wrong way in the wrong climate, and we end up with issues. We end up with air quality issues. We end up with moisture issues, so on and so forth.

So that is a lot of what drives the difficulties is getting the consumer and the industry further along. They have come a long ways in the last 10, 15 years, further along in understanding, on an education level, understanding the complexity of the modern home and a high-performance home so we don't end up with those serious, unintended consequences.

Mr. WALBERG. OK. Thank you.

Mr. Zimmermann, how does customer demand influence the type of products you sell?

Dr. ZIMMERMANN. Certainly, customers are demanding more and more resilient and sustainable products. They may specify that they want to be able to prove that they have a reduced carbon footprint, and we certainly take that into our product design.

Mr. WALBERG. Do they know the specifics that they are looking for or are they expecting somebody to tell them?

Dr. ZIMMERMANN. I think it goes both ways, but certainly we are market driven. The market instructs us in terms of what is important to them for that particular building sector.

Mr. WALBERG. Hence, it would be incumbent upon us in government to make sure that we understand the market as well, understand what is out there.

Dr. ZIMMERMANN. I think there are a lot of technologies out there we can take advantage of, and the more we can understand what the needs are in the marketplace, the better we can service the marketplace.

Mr. WALBERG. OK. Thank you.

I appreciate the courtesy. And I yield back.

Mr. GRIFFITH. I will take that last minute 20 real quick.

Dr. Zimmermann, if you could, does your company have a film that they can add to a window or energy-efficiency film that also is something that the birds can see?

Dr. ZIMMERMANN. I am not aware of anything at this point in time, but I would prefer to get back to you on that.

Mr. GRIFFITH. If you would, because I know the products are out there. Whether your company makes it or not, there are products out there. And if you put it in when you are building the building, the cost is nonexistent or minimal. If you wait till later, of course, obviously it is much more expensive. But with the report coming out yesterday that we have lost up to 30 percent of the birds in North America since 1970, it is something that is high time we take a look at, particularly when the cost is low.

Dr. ZIMMERMANN. I do know we just recently discussed with Terraforma One a unique concrete structure for Monarch butterflies, including a habitat for them. Perhaps we have something for birds as well. I am not aware.

Mr. GRIFFITH. And there are lots of other things you can do, and some of the material I submitted for the record has, you know—and some people wouldn't like this but some do—decorative mesh that you put around the building that lets the light come in, but it makes it a barrier that birds can see so they don't think they are flying into open space and crash into a building and die. When The Guardian publication earlier this year put out an estimate as high as a billion dollars, so it is—I mean, a billion birds—it is a concern.

Dr. ZIMMERMANN. I am happy to look into that.

Mr. GRIFFITH. I yield back.

Mr. RUSH. The Chair now recognizes Ms. Kuster for 1 minute.

Ms. KUSTER. Thank you, Mr. Chair.

Our votes have been called, but I want to commend the Chair and all of you for being here. This is a win-win-win scenario and a very bipartisan hearing, and we can save the planet, save money, create jobs, and, it turns out, save the birds.

I am going to just dive right in. I am a proud cosponsor of my friend Congressman Welch's bill on improving energy efficiency. And my question is about the most cost-effective energy efficiency technologies that can be deployed. And, in particular, I am from a rural district. Is there anything in particular about these technologies for rural communities and homeowners that you would recommend?

Anybody can take it, and our time is short.

Mr. NADEL. I will start. Smart building controls can often be some of the most cost-effective opportunities, particularly in commercial buildings, but also there is some in residential. But the other residential stuff vary very much from home to home or building to building. That also brings into rural areas the need sometimes for rural broadband, which is a whole big issue but something that ultimately we need to address if we are going get all the benefits to all of the U.S. and not just the urban areas.

Ms. KUSTER. And definitely, we are working on that as well. By that, you mean smart technology so that homeowners and business owners can control their energy efficiency and their use?

Mr. NADEL. Often it means having sensors that help identify when something is out of kilter and either automatically adjusting or at least letting people know so that they don't just go for years and years unaware of the problem.

Ms. KUSTER. Any other quick ideas? Quickly.

Mr. BEARDSLEY. First of all, weatherization, so definitely getting better insulation in these buildings. And then, secondly, making sure that there is availability of high-efficiency products and that the workforce is trained so that naturally as HVAC breaks down and needs to be replaced, it is replaced with high efficiency.

Ms. KUSTER. Great. Very helpful. I should have mentioned cold and rural. So, thank you.

Mr. McIntyre, sure.

Mr. MCINTYRE. If I can just make a quick comment on that. The quick analogy, in my perspective, is address the envelope first, address the load of the building first, what the building needs, and then address the efficiencies of what goes into it.

If we put high-efficiency systems into a building that we don't address the building, I have a simple analogy for that that I tell customers regularly and I put in my presentations: That is wasting energy more efficiently.

Ms. KUSTER. Thank you. Having grown up in a very drafty colonial, I can relate. Thank you very much. Thanks for your time.

And thank you, Mr. Chair.

Mr. RUSH. The Chair now requests unanimous consent to enter into the record five documents.

And, without objection, so ordered.

[The information appears at the conclusion of the hearing.]

Mr. RUSH. That concludes the witnesses' questions, and I would like to thank all of our witnesses for their participation in today's hearing.

I must remind Members that, pursuant to committee rules, they have 10 business days to submit additional questions for the record to be answered by the witnesses who have appeared. I ask each witness to respond promptly to any such questions that you may receive.

And at this time, the subcommittee stands adjourned.

[Whereupon, at 10:45 a.m., the subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

PREPARED STATEMENT OF HON. GREG WALDEN

Good morning, Mr. Chairman. This is the second climate change hearing this week, and while Republicans are serious about finding real solutions to address the real issues our constituents are dealing with, Democrats continue to waste time on politics, when we could be passing legislation that already has bipartisan support into law. Let's change the narrative and put progress before politics.

Mr. Chairman, two weeks ago, we highlighted seven bills that are very close to the finish line, but they require you and your Democrat colleagues to act. I am talking about legislation to promote the development of carbon capture and utilization projects; a bill to reduce wildfire risks through active forest management; a bill to promote advanced nuclear energy technology; a bill to cut energy use in Federal buildings; a bill to remove hurdles to energy efficiency improvements; and, a bill to boost R&D for carbon capture technology development. These are just a few examples where Democrats on the committees of jurisdiction and on the NDAA Conference Committee could work with Republicans to reduce emissions, promote clean energy, and conserve our natural resources.

When it comes to ways to save energy and improve the performance of the homes where we live and the buildings where we work, Republicans have solutions that are affordable, cost effective, and appealing to consumers. We don't need a Big Government solution for everything. With a careful balance of incentives and market-driven policies, consumers will choose the products and services that work best for them.

When it comes to Federal buildings, Republicans support public-private partnerships such as Energy Savings Performance Contracts, which offer an innovative solution for the Federal Government to reduce energy consumption at little to no cost to taxpayers.

In my home State of Oregon, we are on the leading edge of developing an innovative new wood product, such as cross-laminated timber, which could be a real game changer for sustainable forest management and low carbon building design. Cross laminated timber has the potential to substantially reduce the carbon footprint of new buildings by replacing steel and concrete with a manufactured wood product in certain applications. These wood products not only sequester carbon, they help us sustainably manage our forests to reduce the risk of wildfire which, as we know in Oregon, contributes to poor air quality and carbon emissions.

Mr. Chairman, rather than following New York and California's example with a "Green New Deal" Federal mandate for buildings, I urge you to work with Republicans on more practical solutions. The costs imposed by these Green New Deal policies fall disproportionately on low income and minority families, many of whom are already forced by the housing crisis to endure long commutes because they cannot find affordable housing close to work. As a result, we end up with more cars on the road and more GHG emissions. This is just one example of the unintended consequences, and precisely why Republicans are advocating a balanced approach that takes these issues into account.

I believe we should encourage the development and use of innovative new building materials such as cross-laminated timber. We should also support the development of new technologies that use less energy, but we need free markets and consumer choice to drive that innovation. Bottom line—the Federal Government could mandate that architects design buildings certain ways, and mandate that builders build structures certain ways; but if consumers cannot afford what they are designing and building, it is all for nothing.

A top-down government mandate will only stifle growth and make homes and buildings more expensive. I firmly believe we can find common ground with solutions that are focused on affordability, cost-effectiveness, and as always, consumers.

As I said on Wednesday, we are waiting at the table and are ready to continue the work we started last Congress. Let's stay focused on real solutions, and let's work together.

Thank you, I yield back.

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September 20, 2019

The Honorable Frank Pallone
Chairman
House Committee on Energy & Commerce
U.S. House of Representatives
Washington, DC 20515

The Honorable Bobby Rush
Chairman
Subcommittee on Energy
U.S. House of Representatives
Washington, DC 20515

The Honorable Greg Walden
Ranking Member
House Committee on Energy & Commerce
U.S. House of Representatives
Washington, DC 20515

The Honorable Fred Upton
Ranking Member
Subcommittee on Energy
U.S. House of Representatives
Washington, DC 20515

Dear Chairman Pallone, Ranking Member Walden, Subcommittee Chairman Rush, and Subcommittee Ranking Member Upton:

Thank you for holding today's important subcommittee hearing - Building a 100 Percent Clean Economy: Solutions for the U.S. Building Sector. Climate change is one of the most important issues of our time, and the science is increasingly clear that we have a very limited amount of time to address it in a meaningful way. I wanted to provide Microsoft's perspective for the hearing record on our company's long-standing commitment to sustainability, which includes instituting a company-wide carbon tax, increasing the amount of renewable energy we use to power our operations until we get to 100%, and reducing carbon emissions by 75 percent by 2030.

But no matter how much any one company does, we need to look outside our four walls to drive the large-scale change we need. That is where technology and public policy comes in. One area where we see a great deal of potential for innovation and carbon reduction is the building sector, both in terms of operational carbon and embodied carbon (the carbon related to building construction and materials).

The built environment accounts for close to 40% of annual carbon dioxide (CO₂) emissions worldwide due to the energy required to operate existing buildings, including lighting, equipment, heating and cooling. These emissions are referred to as operational carbon emissions. As the global population expands, [Architecture 2030](#) estimates that the world will need to double the amount of building floorspace. This is equivalent to building an entire New York City every month for the next 40 years. Most of the carbon footprint of these new buildings will take the form of embodied carbon — the emissions associated with building construction, including extracting, transporting, and manufacturing materials.

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We believe there is a huge opportunity to significantly reduce this embodied carbon footprint and catalyze a new market for low carbon building materials and processes. Our position is informed by what we are doing with our own operations and a coalition of partners.

At Microsoft's headquarters in Redmond, Washington, we have started work to construct 17 new buildings totaling 2.5 million square feet. Operationally, we will remove fossil fuels from these new buildings and run this new addition, as well as the rest of our campus, on 100 percent carbon-free electricity. From an embodied carbon perspective, we have set a target to reduce the carbon associated with the construction materials of these new buildings by at least 15 percent versus business as usual, with a goal of reaching 30 percent.

Microsoft's Silicon Valley Campus is similarly designed with carbon in mind. This new campus design retains two of the original structures and leverages Forest Stewardship Council (FSC) certified mass timber as a structural component for the remainder of this almost 650,000 square foot campus. When the campus opens in 2020, the use of mass timber will cut our embodied carbon emissions by 50 percent.

Through these sizeable pilot projects, we aim to enable the broader construction industry to measure and manage this big piece of the built environment carbon puzzle. To assist in the process, we are partnering with the University of Washington's Carbon Leadership Forum and Skanska to develop and deploy a new digital tool to track and reduce embodied carbon. The Embodied Carbon in Construction Calculator ("EC3") is an open source, free to use tool designed for use by architects, engineers, owners, construction companies, building material suppliers and policy makers to measure, compare and reduce embodied carbon emissions from construction materials. The tool will be released to the public in November 2019. Additional background can be found at www.carbonleadershipforum.org and <https://buildingtransparency.org/>.

As the committee evaluates opportunities to reduce carbon emissions and encourage innovation, we hope you will include embodied carbon efforts such as the EC3 in your discussions. We applaud your focus on this issue and welcome the opportunity to discuss these efforts in more detail. Thank you.

Sincerely,

A handwritten signature in black ink, appearing to read "Lucas Joppa".

Dr. Lucas Joppa
Chief Environmental Officer
Microsoft



The Honorable Bobby Rush
Chairman
Energy and Commerce Committee
Subcommittee on Energy
U.S. House of Representatives
Washington, DC 20515

The Honorable Fred Upton
Ranking Member
Energy and Commerce Committee
Subcommittee on Energy
U.S. House of Representatives
Washington, DC 20515

Dear Chairman Rush and Ranking Member Upton:

As leaders in the residential energy efficiency industry, E4TheFuture and the Building Performance Association appreciate the opportunity to provide the following comments for the record regarding the September 20th hearing on "Building a 100 Percent Clean Economy: Solutions for the U.S. Building Sector." The Building Performance Association (BPA) is a national non-profit 501c3 organization that works with industry leaders in the home performance and weatherization industries to advance energy-efficient, healthy and safe homes retrofit policies, programs and standards through research, education, training and outreach. E4TheFuture is non-profit 501c3 organization which collaborates with industry stakeholders to provide expert policy solutions, education, and advocacy to advance residential clean energy and energy efficiency solutions on the federal, state and local level.

The residential sector remains a largely untapped resource for carbon reduction goals. Residential buildings consume more electricity than any other sector¹ and are the largest contributor to peak demand,² which makes this sector particularly important from a carbon emissions reduction standpoint. Legislation aimed at reducing carbon emissions must include residential considerations and should be developed in a way that helps the U.S. economy grow by: (1) creating jobs, (2) promoting innovation, and (3) providing a return on investment to the American public in a fair and equitable manner. Policies and legislation aimed at advancing energy efficiency, particularly residential energy efficiency, achieve all three of those goals.

Jobs: While renewable energy resources will be needed, we cannot overlook the largest employer in the energy sector: energy efficiency. Put simply, energy efficiency equals jobs. The 2019 "Energy Efficiency Jobs in America"³ report from E4TheFuture found that the energy efficiency industry employs approximately 2.32 million Americans and is adding more jobs than any other energy sector.⁴ A significant portion of the energy efficiency jobs in the U.S. are in the residential sector, and approximately 56% of energy efficiency jobs involve construction and repairs. These are the contractors – the "boots on the ground" – installing energy efficiency products and technologies and working to reduce energy waste in homes and buildings across the country. These jobs are, by their very nature, inherently local and cannot be exported. In fact, the E4TheFuture report found that

¹ https://www.eia.gov/electricity/annual/html/epa_01_02.html

² https://www.energy.gov/sites/prod/files/2019/04/f61/bto-geb_overview-4.15.19.pdf

³ <https://e4thefuture.org/new-report-energy-efficiency-workforce-grows-to-over-2-3-million/>

⁴ An updated version of the Energy Efficiency Jobs Report will be published in September 2019, and we anticipate growth in energy efficiency jobs across the country.

99.7% of U.S. counties have energy efficiency jobs and that energy efficiency now employs workers in more than 3,000 of America's 3,007 counties.

Innovation: Within the energy efficiency industry, the building efficiency sector is undergoing rapid change and is increasingly a source of innovation and new technology. Thanks to advances in technology, our nation's buildings—and the residential sector in particular—can be enabled to play an important role in managing energy demand to support efficiency and resiliency for the grid and achieve significant carbon reductions. The U.S. Department of Energy (DOE) Building Technologies Office (BTO) has been doing a lot of work in this area of “Grid-interactive Efficient Buildings” (GEBs).⁵ GEB technologies (e.g. smart thermostats, efficient connected appliances, and home energy management systems) make homes smart, connected, efficient and flexible, allowing them to reduce or shift energy use to take advantage of variable renewable energy and support a cleaner grid, while helping American families lower their utility bills and increase comfort and convenience. Importantly, GEBs can provide energy efficiency and demand flexibility as a cost-effective clean energy solution that reduces carbon emissions. A recent study by Rocky Mountain Institute⁶ found that Clean Energy Portfolios of wind, solar, storage, energy efficiency, and demand flexibility are now cost-competitive with new natural gas plants, while providing the same reliability services currently serviced by natural gas.⁷

In order to take advantage of these cost-effective clean energy resources, policy approaches must be welcoming to innovation and provide a level playing field for all combinations of technologies and distributed energy resources, like residential GEBs, to compete.⁸ Policy and regulatory measures that advance grid-interactive efficient homes can support grid modernization and resiliency, while working hand in hand with carbon reduction and energy policy goals, such as Energy Efficiency Resource Standards, Renewable Portfolio Standards, Clean Peak Standards, and strategic electrification that aim to reduce emissions and create a new need for demand-side load management. The policy and regulatory environment can encourage or dissuade investment in residential grid-interactive efficiency. In some cases, the technology is already there to be utilized, but policies are not in place to capture its value and incentivize its use. For market solutions to provide the most powerful impact, participation should be based on outcomes rather than specific technology configurations. New policy frameworks should welcome and enable innovative solutions that will lead to the energy economy transformation that we are all striving for. See #3 for specific policy suggestions.

⁵ A series of NASEO-NARUC GEB briefing papers is currently being published. Publication of a draft briefing paper on residential GEBs, entitled “Residential Grid-Interactive Efficient Building Technology and Policy: Harnessing the Power of Homes for a Clean, Affordable, Resilient Grid of the Future” is expected by October 2019 and a copy of the report will be provided to the Committee.

⁶ <https://rmi.org/insight/clean-energy-portfolios-pipelines-and-plants>

⁷ The study also found that energy efficiency and demand flexibility—resources that GEBs can provide—are the least-cost route to meeting energy, capacity, and flexibility needs.

⁸ ISO New England has allowed energy efficiency to compete with traditional and renewable generation in its Forward Capacity Market for over a decade. Recent findings show the dramatic impact of energy efficiency investments on reducing the energy intensity of the regional economy. https://iso-ne.com/static-assets/documents/2019/09/a2_supplemental_information_on_changes_in_the_celt_2019_summer_demand_forecast_presentation.pptx

Fair and equitable benefits: policies aimed at retrofitting the over 115 million homes across the country will not only help reduce carbon emissions from the nation's residential building stock, but will also help homeowners save money on their monthly utility bills and improve the comfort, health, safety, and resiliency of their homes. Reducing monthly energy costs of homes is something that will benefit every American, as energy costs represent the second or third largest cost of homeownership, depending on location (behind mortgage and in some markets property tax). The Committee should advance policies aimed at helping middle income Americans make efficiency upgrades to their own homes (e.g. HOMES Act) as well as programs designed to make efficiency upgrades to low income homes (e.g. Weatherization Assistance Program). See list of recommended legislation in #3.

In addition to the cost-savings benefits to homeowners, efficiency upgrades also have health and safety benefits. A U.S. Department of Energy report on the Weatherization Assistance Program⁹ found that home improvements focused on energy efficiency can improve indoor air quality, which reduces respiratory illness and sick days, and boosts mental alertness and productivity for both children and adults. A report from E4TheFuture, entitled "Occupant Health Benefits of Residential Energy Efficiency,"¹⁰ which reviews existing research on the link between resident health benefits and energy efficiency upgrades, also found that residential energy efficiency upgrades can produce significant improvements in asthma symptoms and help improve overall physical and mental health.

The residential building sector is particularly difficult to decarbonize, as many homes are decades old and incredibly inefficient. Retrofitting these homes could achieve significant energy and carbon savings, however each house is unique and the barriers that exist in terms of financing, homeowner education and engagement, and proper valuation of efficiency characteristics of residential buildings all make it a difficult sector to tackle from a policy perspective. The Committee should support policies and legislation that help advance a pay-for-performance model¹¹ for residential energy efficiency, like the pilot program included in the 116th version of the HOMES Act and the REEVA discussion draft (described in more detail below).

The following pieces of legislation and policy proposals represent a multi-pronged policy approach to reducing carbon emissions in the residential building stock:

Home Owner Managing Energy Savings (HOMES) Act of 2019 (116th – HR 2043, Rep. Welch). Would establish a grant program for rebates to make residential energy efficiency upgrades with a network of rebate aggregators, quality assurance, and pilot on pay for performance. Earlier iterations of the

⁹ <https://energy.gov/eere/wipo/downloads/weatherization-assistance-program-national-evaluation>

¹⁰ <https://e4thefuture.org/occupant-health-benefits-of-residential-energy-efficiency/>

¹¹ Pay for performance (P4P) is a measured savings model through which incentives are given based on realized energy savings, rather than upfront payments for deemed savings attributed to a particular technology or measure. This model offers important flexibility to target different homes with unique approaches while ensuring accountability. The model offers an opportunity for incentivizing solutions delivered where and when they are needed most to support the grid of the future. Because P4P is technology-agnostic and based on outcomes rather than prescriptive measures, the paradigm could encourage the use of multi-measure approaches (different technologies and solutions) that work together to make homes more energy efficient and achieve carbon reductions.

HOMES Act from previous Congresses have been bipartisan with Rep. McKinley (R-WV). The 116th version is with legislative counsel for updates.

Access to Consumer Energy Information Act or the E-Access Act (116th – discussion draft, Rep. Welch) (114th – HR 1980/S 1044, Rep. Welch (D-VT), Rep. Cartwright (D-PA) / Sen. Markey): Would allow DOE to facilitate customers’ access to their own electricity data, adds consumer access to energy use and price data to State energy conservation plans, and provides for establishment of voluntary guidelines with access to third parties according to a protocol established by the Secretary.

Residential Energy Efficiency Valuation Act of 2015 “REEVA” (114th draft language): A short term grant program to states to provide incentives based on measured energy savings from energy efficiency upgrades of residential buildings. Payments are to contractors/aggregators based on performance. The contractor/aggregator is to utilize financing to provide market-based incentives for their customers. *Language available from the Building Performance Association.*

Sensible Accounting to Value Energy (SAVE) Act (114th – HR 614/ 113th – S 1106, Rep. Murphy, Rep. Jolly / Sen. Bennet, Sen. Isakson): HUD to develop and issue guidelines to all federal mortgage agencies to implement enhanced loan eligibility based on energy cost savings due to efficiency upgrades. Supported by the NAHB and many others. Included in the Energy Savings and Industrial Competitiveness Act (HR 3962, S2137).

Blue Collar to Green Collar Jobs Development Act of 2019 (116th – HR 1315, Rep. Rush): Would establish an energy workforce grant program, which would provide assistance to businesses in the energy efficiency and renewable energy industries that are seeking to educate and train new hires and existing employees. Similar to S 2393, Clean Energy Jobs Act (Sen. Heinrich).

Weatherization Enhancement and Local Energy Efficiency Investment and Accountability Act (HR 2041, Rep. Tonko, Rep. Rush, Rep. Kaptur): Would reauthorize and make updates to the Weatherization Assistance Program. Passed out of Committee during 116th Congress, awaits a floor vote.

Additional Policy Proposals

Energy Efficiency Resource Standard (EERS). Direct electric and natural gas utilities to achieve increasing levels of energy savings through cost-effective customer energy efficiency programs. States could administer the program, and limited credit trading would be allowed.

Smart Homes Act - This proposed language could be added to the “Smart Building Acceleration Act,” H.R. 5069 introduced by Rep. Welch or introduced separately. It would add residential buildings and facilitate the transition to smart buildings, supporting research, and documenting the costs and benefits of emerging technologies in the residential market. *Language available from the Building Performance Association.*

Efficiency Requirements for New Homes with Assisted Loans - Update HUD/USDA/VA efficiency requirements for new homes with assisted loans and public housing. Federal agencies have efficiency requirements for new homes with federal loan guarantees and federal loans, as well as

public housing with federal assistance. However, FHA loans are still using the 2009 IECC, and some others the 1992 MEC. Should update EAct 1992/EISA legislative authorities to refer to most recent code and clarify administrative update requirements.

We appreciate the Subcommittee's continued work to explore legislative proposals to reduce carbon emissions from the various sectors of the U.S. economy. We believe residential buildings are key to achieving the full Committee's stated goal of net-zero by 2050. Again, thank you for providing this opportunity to submit comments for the record. We look forward to working with you.

Contact Information

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September 19, 2019

The Honorable Frank Pallone
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The Honorable Greg Walden
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The Honorable Bobby Rush
Chairman, House Committee on Energy and
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United States House of Representatives
2188 Rayburn House Office Building
Washington, DC 20515-1301

The Honorable Fred Upton
Ranking Member, House Committee on
Energy and Commerce
Subcommittee on Energy
United States House of Representatives
2183 Rayburn House Office Building
Washington, DC 20515-2206

Dear Chairman Pallone, Chairman Rush, Ranking Member Walden and Ranking Member Upton,

To enhance the affordability of a home and reduce carbon in the most cost-effective manner, we need a level playing field between solar photovoltaic ("PV") technologies (i.e. solar panels) and energy efficiency measures in residential building codes. Once a builder has met the energy efficiency requirements on a non-solar home under the performance path contained in the 2018 IECC codes, solar panels and energy efficiency measures work in a symbiotic manner and can be treated as interchangeable substitutes. This can be done by implementing the below definition for equivalency, as well as a reasoning statement inclusive of the rationale offered below.

The term "energy efficiency" should incorporate a clarification on the issue of equivalency:
"Equivalency — The Secretary shall treat one unit of renewable energy production as equivalent to one unit of renewable energy savings after the energy efficiency requirements of the 2018 performance path for the home's envelope measure."

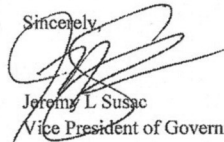
The correspondence between PV technologies and energy efficiency measures can be understood as follows: The Energy Rating Index ("ERI") is a voluntary path that ensures robust insulation and building envelope measures while enabling on-site renewables that enhance the affordability of a home in select climate zones. In the process of development of the 2018 IECC, in the Public Comment version, RE173-16, the ERI target scores are fundamentally modified by language inserted into a punitive footnote. The result of this change is differential treatment for building projects based on whether construction includes an on-site renewable energy system. Projects incorporating a renewable energy system to offset the consumption of energy and to reduce energy flows at the meter are artificially constrained and rendered meaningless in this revised compliance option by requiring higher level envelope measures than a non-solar home. Once a builder uses the higher envelope measures, the builder achieves compliance without solar. Thus, the 2018 ERI path – the only path for renewables in the I-codes – renders solar meaningless from a compliance perspective.

This significant alteration is punitive to homebuilders and is an impediment to the affordability of a home. The voluntary path now produces an ERI compliance option focused exclusively on energy efficiency as the only compliance tool by artificially constraining the role of renewable energy systems. Under this more expensive option, the ERI target score is less stringent and will only be met with energy efficiency. Whether the footnote was intentionally or unintentionally inserted, the addition of this footnote to the code creates a disincentive for builders to use renewable energy systems in the ERI path. As a result, no builder will use solar as a compliance option which is inconsistent with purpose and intent of building energy codes.¹ Energy codes should address 100% of the home's energy load, and only a path that uses both energy efficiency and renewables can address 100% of the home's energy load.

As presented by the Building Technologies Office of the Department of Energy's 2018 National Energy Codes Conference, according to the U.S. Energy Information Administration's AEO 2018 report, "typical residential end uses include energy production for space heating and space cooling, which combined amount to 35% of all residential energy end uses. Water heating accounts for 13.5% of residential energy end uses."

Mr. Chairman, we have done a very good job of reducing regulated loads, such that unregulated loads (such as lighting loads, appliance loads, and plug loads) now represent greater than 50% of all residential energy end uses. In terms of regulated loads, typical residential end uses include energy production for space heating and space cooling, which combined amount to 35% of all residential energy end uses. Water heating accounts for 13.5% of residential energy end uses. Note, only renewable energy systems can provide a whole-home approach by offsetting both the unregulated loads, and reduce regulated loads.

In conclusion, both energy efficiency and renewable energy systems must be interchangeable. Compliance measures and compliance paths that focus only on building envelope measures and discourage or penalize renewable energy systems— or fail to make renewable energy systems attractive to builders as a compliance option— are focused on solving 35% of the problem. The IECC should encourage the use of energy efficiency measures PLUS renewable energy systems, to solve 100% of the problem. In fact, we know that new homes with PV systems and electric vehicle ("EV") chargers can also power our consumer vehicles with sunlight, solving greater than 100% of the building energy problem. We urge you to tell the Department of Energy that you would like to see the equivalency standard for renewable energy adopted in all future IECC standards.

Sincerely,

 Jeremy L. Susac
 Vice President of Government Affairs

¹ The International Energy and Conservation Code is created and guided by federal law. Specifically, 42 U.S. Code § 6831(b)(2), "provide[s] for the development and implementation, as soon as practicable, of voluntary performance standards for new residential and commercial buildings which are designed to achieve the maximum practicable improvements in energy efficiency and increases in the use of nondepletable sources of energy."



AMERICAN PUBLIC GAS ASSOCIATION

September 20th, 2019

The Honorable Bobby Rush
Chairman, House Energy and Commerce Committee Subcommittee on Energy
2188 Rayburn House Office Building
Washington, DC 20515

The Honorable Fred Upton
Ranking Member, House Energy and Commerce Committee Subcommittee on Energy
2183 Rayburn House Office Building
Washington, DC 20515

Re: Energy and Commerce Committee Subcommittee on Energy Hearing on “Building a 100 Percent Clean Economy: Solutions for the U.S Building Sector”

Dear Chairman Rush and Ranking Member Upton,

APGA represents roughly 1,000 retail natural gas distribution entities owned by, and accountable to, the citizens they serve. They include municipal gas distribution systems, public utility districts, county districts, and other public agencies that own and operate natural gas distribution facilities in their communities. Public gas systems’ primary focus is on providing safe, reliable, and affordable natural gas service to their customers. APGA members serve their communities in many ways. They deliver natural gas to be used for cooking, clothes drying, and space and water heating, as well as for various commercial and industrial applications. We appreciate the opportunity to submit input on this important hearing to examine solutions for building energy efficiency.

APGA Believes in an Energy Efficient Building Sector

At the most basic level, APGA represents the views of American consumers and wants to help public natural gas utilities meet their needs in an environmental and energy efficient way, through supplying sustainable and affordable natural gas to heat homes and water, cook meals, and dry clothes, as well as power restaurants, schools and hospitals, and service businesses of all

types. As the debate on our energy future continues, it is clear that energy efficiency will be one of the foundations on which we build.

It is critical that energy efficiency measures be based on sound science, transparent data, and achieve substantial energy savings for the cost incurred. APGA members support comprehensive policies achieving this goal, since they desire to be good stewards of the environment. However, any policy must not jeopardize the affordability and reliability of the nation's energy matrix. By forcing a fuel-switch to a single end-use technology (electricity) rather than focusing on a pathway to emissions reductions, energy affordability and grid reliability is threatened. Low-cost natural gas, environmentally-responsible renewable natural gas, and the existing infrastructure can play a significant role in reducing emissions from our nation's buildings, both residential and commercial.

APGA's members are also investing in innovation, knowing it is key for energy efficiency progress. While there are more customers using natural gas, the overall throughput is declining.¹ Better insulation, tighter-fitting windows and doors, and even programs championed by APGA's members are allowing for more efficient buildings. In addition to these, APGA supports investments and research into renewable natural gas technology and energy storage through electrolysis, advances that truly achieve a clean and balanced energy future. Public gas utilities have a proactive focus on innovation that helps Americans achieve utility bill savings and lessen environmental impacts.

Natural gas should be a part of any U.S. effort to meet emission reduction objectives given the highly efficient nature of direct use technologies. APGA urges the Subcommittee to fully consider the benefits of natural gas direct use and maintain energy end-use diversity, as it considers policies intended to address the delivery of energy in a manner that minimizes environmental impacts.

Natural Gas Use in Residential Buildings

APGA supports balanced energy solutions that achieve environmental benefit. Residential natural gas appliances are highly efficient and can achieve emissions reductions and consumer savings. On a source-energy basis, natural gas appliances are 92% efficient. That is, 92% of the energy produced and delivered is consumed by the appliance at the point of use.

¹ AGA, "Natural Gas Safety, Resilience, Innovation, 2019 Playbook," <http://playbook.aga.org/#p=14>.

Comparatively, electric appliances are only 37% efficient.² Requiring consumers to eliminate natural gas as an option forces consumer to choose potentially less efficient and more costly appliances.

Residential natural gas consumption only accounts for 4% of total US GHG emissions.³ However, the gas distribution industry continues to innovate to cut emissions across the sector. For example, APGA's Research Foundation is focused on developing a low-cost, efficient, natural gas-fired heat pump, coordinating with the Gas Technology Institute (GTI) in this effort.⁴ Another valuable technology is the use of micro-combined heat and power (CHP) system.⁵ These generate on-site electricity from natural gas and recycle waste heat for building operations, resulting in a highly-efficient system. CHP is often used in hospitals, universities, and other larger applications, but increased deployment opportunities in the residential sector exist and should be explored. The Subcommittee can guide the Department of Energy (DOE) in investing in natural gas appliance technologies to improve efficiency, allowing for decreased GHG emissions. APGA is fully committed to ensuring the residential building sector continues to innovate ways to increase energy efficiency and firmly believes that natural gas is a key, not an obstacle in this mission.

Americans also want natural gas in their homes. Take California, for example. Recent data shows less than 10% of voters would choose an all-electric home, and 80% oppose prohibiting the use of gas appliances.⁶ Forcing fuel switching would also be burdensome. A survey of California families shows electrification will cost \$7,200 to retrofit a home and \$388/year more in energy bills.⁷ A national study shows families would have to spend, on average \$4,847, to replace four common household appliances: range, dryer, water heater, and furnace.⁸ APGA encourages considering balance with costs and environmental benefits when

² AGA, "Natural Gas Safety, Resilience, Innovation, 2019 Playbook," <http://playbook.aga.org/#p=50>.

³ AGA, "Natural Gas Safety, Resilience, Innovation, 2019 Playbook," <http://playbook.aga.org/#p=44>.

⁴ GTI, "Enhancing Efficiency in Space Conditioning and Water Heating," <https://www.gti.energy/enhancing-efficiency-in-space-conditioning-and-water-heating/>.

⁵ GTI, "Improving Technology, Proving Feasibility, and Reducing Costs of Micro-CHP,"

<https://www.gti.energy/improving-technology-proving-feasibility-and-reducing-costs-of-micro-chp/>.

⁶ California Building Industries Association, California Natural Gas Poll - Consumer Survey of 3000 California Voters

⁷ Navigant Consulting, "The Cost of Residential Appliance Electrification: Phase 1 Report – Existing Single-Family Homes"

⁸ Consumer Energy Alliance, "Green New Deal Would Cost American Consumers Almost \$244 Billion in Just Four Appliances," <https://consumerenergyalliance.org/2019/02/green-new-deal-would-cost-american-consumers-244-billion-four-appliances/>

evaluating energy policies, realizing energy efficiency gains do not need to come at undue consumer expense.⁹

The Role of Natural Gas in Commercial Buildings

As the world's largest real estate holder, the federal government can be a leader in building efficiency by deploying highly-efficient natural gas technologies across their portfolio. However, Section 433 of the Energy Independence and Security Act of 2007 (EISA 2007) mandates elimination of all fossil fuel-generated energy use in federal buildings by the year 2030. The mandate covers new buildings and major renovations (defined as at least \$2,500,000 in 2007 dollars), limiting and ultimately eliminating the role of natural gas in federal facilities. Section 433 creates a bias in federal policy, opposing the important role that domestically abundant, clean, and affordable natural gas can serve, meeting the energy needs of not only federal buildings but the country as a whole. Specifically, the mandate seeks to reduce fossil fuel use by 65% by 2020 with total elimination by 2030 and will prohibit both the ultra-efficient direct use of natural gas in federal buildings and the use of gas-fired generation, which is the preference today by most utilities in the nation to minimize the effects of GHGs. For example, Section 433 would restrict the adoption of the previously discussed, highly-efficient CHP systems. By restoring the ability of federal installations to utilize natural gas, energy managers will be able to use any energy efficient, cost-effective end-use applications of natural gas in the long-term.

It should be noted that federal buildings, many of which receive natural gas from APGA members, must have a resilient and reliable energy supply. Natural gas has a track record of consistent service. During both Hurricane Harvey in 2017 and the 2018 Bomb Cyclone, or "snow hurricane," natural gas service was maintained.¹⁰ Doesn't the federal government deserve this reliability?

Given this evidence, APGA asks that the Subcommittee consider H.R. 2664, the "All-of-the-Above Federal Building Energy Conservation Act of 2019" and pass this legislation. It makes the appropriate updates to allow for efficient energy use in federal buildings.

⁹ Martin, Emmie, CNBC, "Only 39% of Americans Have Enough Savings to Cover a \$1,000 Emergency," <https://www.cnbc.com/2018/01/18/few-americans-have-enough-savings-to-cover-a-1000-emergency.html>

¹⁰ Natural Gas Council, "Natural Gas Reliable and Resilient Report," <http://naturalgascouncil.org/natural-gas-reliable-and-resilient/>

Other efficiency gains can be made in commercial applications. The APGA Research Foundation, through its partnership with GTI, has focused on high-efficiency natural gas commercial equipment and foodservice appliances.¹¹ This work involves a variety of commercial kitchen equipment, such as fryers and ranges. Chefs prefer natural gas, since it is quick, controllable, and affordable. Natural gas needs to remain a fuel for restaurants around our nation.

Conclusion

APGA appreciates the opportunity to submit testimony before the Subcommittee on this critical public interest issue. We hope the balance of environmental impact and consumer choice and affordability will be considered, while any policy is developed. Natural gas direct use in residential and commercial buildings is critical to achieving our country's environmental objectives, and its use will not jeopardize reliability, affordability, and resiliency of the energy systems serving all Americans. We stand ready to work with the Committee and Subcommittee on this and other issues.

¹¹ GTI, "Creating a Suite of High-Efficiency Natural Gas Commercial Equipment and Foodservice Appliances," <https://www.gti.energy/creating-a-suite-of-high-efficiency-natural-gas-commercial-equipment-and-foodservice-appliances/>



September 20, 2019

The Honorable Bobby Rush
Chairman, Energy Subcommittee
House Committee on Energy and Commerce
2125 Rayburn House Office Building
Washington, DC 20515

The Honorable Fred Upton
Ranking Member, Energy Subcommittee
House Committee on Energy and Commerce
2125 Rayburn House Office Building
Washington, DC 20515

Dear Chairman Rush and Ranking Member Upton,

The American Gas Association (AGA) is writing regarding today's hearing, "Building a 100 Percent Clean Economy: Solutions for the U.S. Building Sector." As the Energy and Commerce Subcommittee on Energy explores ways to reduce greenhouse gas emissions in the building sector, any realistic plan for a clean and secure energy future in all sectors of the economy must include natural gas as a foundational fuel source. Instead of looking for single pathway solutions such as banning an entire fuel source, AGA encourages the Subcommittee to work to reduce emissions by focusing on how consumers use energy and its overall environmental impact.

AGA, founded in 1918, represents more than 200 local energy companies that deliver clean natural gas throughout the United States. There are more than 74 million residential, commercial and industrial natural gas customers in the U.S., of which 95 percent — more than 71 million customers — receive their gas from AGA members. AGA is an advocate for natural gas utility companies and their customers and provides a broad range of programs and services for member natural gas pipelines, marketers, gatherers, international natural gas companies and industry associates. Today, natural gas meets more than one-fourth of the United States' energy needs.

If the true intent of this hearing is to limit carbon emissions, Congress should not be looking at the source of energy but rather at how the energy is being used. The elimination of natural gas usage in federal buildings — or any residential, commercial, or industrial building — will not solve our current climate or other air pollution issues. What will impact the emission rates is changing how we use energy and prioritizing efficiency.


George Lowe *Vice President, Governmental Affairs and Public Policy*

400 N. Capitol St. NW, 4th Floor, Washington, DC 20001 P 202-824-7020 F 202-824-9091 www.aga.org

One of the immediate steps that Congress can take that would have a lasting environmental impact is to reverse Section 433 of the Energy Independence and Security Act of 2007 (EISA). Section 433, which has never been implemented because of the complexities of interpreting this provision, limits and ultimately eliminates the use of natural gas generated energy from federal buildings by 2030 — causing uncertainty for energy providers and federal facilities. H.R. 2664, the All-of-the-Above Federal Building Energy Conservation Act, would reverse Section 433 of EISA while strengthening several existing federal energy management provisions to ensure large energy savings in the coming years, including enhancing energy intensity reductions; allowing flexibility in energy audits; and requiring energy managers to implement cost-effective efficiency measures.

Thank you for considering AGA's support for H.R. 2664. We look forward to continuing to share more about how natural gas utilities play an integral role in reducing greenhouse gas emissions as the Subcommittee on Energy works to develop comprehensive climate legislation.

Sincerely,

A handwritten signature in cursive script, appearing to read "George Lowe".

George H. Lowe,
Vice President, Governmental Affairs and Public Policy



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September 20, 2019

Committee on Energy and Commerce
 Subcommittee on Energy
 2125 Rayburn House Office Building
 Washington, DC 20515

Via email

Re: Testimony of the International Code Council on the U.S. House Energy and Commerce Energy Subcommittee's Hearing on: "Building a 100 Percent Clean Economy: Solutions for the U.S. Building Sector"

The International Code Council (ICC) is a member-focused association dedicated to helping the building community and the construction industry provide safe, resilient, and sustainable construction through the development and use of model codes (the I-Codes) and standards used in the design, construction, and compliance processes. Most U.S. states and communities, federal agencies, and many global markets choose the I-Codes to set the standards for regulating construction, plumbing and sanitation, fire prevention, and energy conservation in the built environment.

The design and construction of new buildings and major renovations are governed by building codes. ICC's model building codes are "voluntary consensus standards" under Office of Management and Budget (OMB) Circular A-119 and the National Technology Transfer Advancement Act (NTTAA), meaning they are developed in an open forum—with a balance of interests represented and due process—that, ultimately, ensures a consensus outcome. State and local governments adopt, amend, and enforce model building codes to advance policy goals and to ensure the health, safety, and welfare of their residents.

ICC develops the International Energy Conservation Code (IECC), which provides for the energy efficient construction of residential and commercial buildings. The IECC is updated every three years and, like other building codes, has advanced with each subsequent code cycle. The 2018 IECC represents a [more than 30% improvement](#) in efficiency over the 2006 IECC edition.

The code captures policies and practices that lead to reduced energy use and greenhouse gas emissions. It addresses the design of energy-efficient building envelopes and the installation of energy-efficient mechanical, lighting, and power systems through requirements emphasizing performance. Between 2010 and 2040, the U.S. Department of Energy expects that model building energy codes will save up to [12.82 quads](#) of primary energy associated with building energy use. The IECC is in use in 49 states.

The Department of Energy's Building Technologies Office (BTO) supports the development and implementation of building energy codes, like the IECC, by providing technical assistance for code development, adoption, and compliance. BTO coordinates with stakeholders to improve model energy codes and provides technical assistance to states implementing updated energy codes. The purpose of BTO's dedicated [Building Energy Codes Program \(BCEP\)](#) is to "improve building energy efficiency, and to help states achieve maximum savings" by "advancing building codes."



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ICC also develops the International Green Construction Code (IgCC), a collaboration between the Code Council, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), the U.S. Green Building Council (USGBC), and the Illuminating Engineering Society (IES), which provides a code-based approach to achieving sustainability objectives. The IgCC is in use in 16 states and DC. [GSA requires the IgCC](#) for the construction and renovations it supervises. The IgCC contains criteria aimed at reducing the impact of buildings on the community and surrounding environment. Covered topics include:

- Site selection to limit heat islands and support transportation efficiency;
- Water use efficiency measures;
- Enhanced energy efficiency measures;
- Material use, including limiting construction waste, encouraging use of recycled or salvaged materials, and conducting life-cycle assessments; and
- Construction and operations actions to limit construction impacts and support ongoing achievement of sustainability objectives.

Beyond the development of an energy efficiency code and a green code, the Code Council has undertaken several additional activities that support advancement of energy efficiency and clean energy solutions. We have begun convening members and other interested stakeholders to identify potential guidance that builds off the existing code infrastructure to deliver zero energy buildings and reduce the embodied carbon in buildings.

The ICC Evaluation Service (ICC-ES) provides product certifications for clean energy technologies through the Solar Rating & Certification Corporation (SRCC). These certifications provide manufacturers with a mechanism to test and rate the performance of their equipment while providing consumers with assurance of the safety and durability of the products. As interest in deploying these technologies grows to meet energy and GHG reduction goals, the testing and certification of these products becomes increasingly important. Product certification is a valuable tool to assure safety, durability, and performance that Congress and the federal government should consider in developing technology deployment efforts. The ENERGY STAR and ITC programs current cite to SRCC certifications to ensure the quality of incentivized products.

I. Building Codes as Tool to Promote Energy Efficiency and Emissions Reduction

Energy codes and green codes by their very nature provide a scalable solution to address new construction and major renovations. They are designed to apply nationwide and provide a common basis for designers, manufacturers, and contractors who support construction activity across the country.

When applied effectively, the model energy and green construction codes provide a sound foundation for energy efficient and low carbon intensity buildings. The private sector driven, consensus-based development process assures that all stakeholders are given the opportunity to participate in the process and therefore buy into the results. This process allows the code to be updated every three years, providing certainty for the building industry and the communities that rely on the code while also



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allowing for the incorporation of the latest technologies and practices that improve buildings. The existing code development process along with supplementary guidance and tools provides the building industry with a path forward to achieving significant energy and greenhouse gas emission reductions—including achievement of zero energy buildings.

[Analyses show](#) buildings generally need to be 50 to 80 percent more efficient than the 2006 IECC, depending on occupancy and climate zone, to potentially be considered net zero. Given that the 2018 IECC is, depending on occupancy and climate zone, 33 percent more efficient than the 2006 IECC, cost-effective net zero construction would require a further reduction of approximately 20 to 50 percent. Last year, the U.S. Conference of Mayors passed a [resolution](#) urging the use of the IECC to achieve net zero building construction by 2050. An average 2 to 4.5 percent decrease in energy use over each of the 11 code cycles from the 2018 IECC to the 2051 IECC would accomplish the mayor's resolution.

Many of the communities that rely on the I-Codes have adopted greenhouse gas reduction goals and are leveraging the I-Codes to achieve them (the U.S. Conference of Mayors being one example). ICC is committed to assisting these communities in developing the tools and guidance that will help them achieve these goals.

II. Federal Policies that Leverage Codes to Promote Efficiency and Emissions Reduction

The efficiency and emissions reduction benefits modern codes provide can be leveraged through several policy pathways, all which utilize existing law or build off prior successes.

A. Offer significant incentives to encourage the adoption and enforcement of current green construction and model energy codes, including the IECC and IgCC

The IgCC is typically used for state owned buildings or provided as a voluntary or stretch option in the 16 states in which it has been adopted. In 12 of these states, the IgCC is in use by a limited number of local governments. Given its usage, a significant opportunity exists to expand its adoption both for government owned buildings and community-wide.

Sixteen states currently employ commercial or residential energy codes that are 9 or more years out of date. Current codes are more than 25% more efficient. Six states do not require local energy code adoption. In these states, adoption (if any) is determined at the local level. Were these 22 states and the communities within them to track current energy codes, our nation's energy efficiency would increase significantly.

Improved energy code enforcement is also critical. To achieve the projected [\\$126 billion energy cost savings](#) DOE has estimated codes can provide through 2040, codes must be fully implemented. DOE [residential field studies](#) have demonstrated that adequate training is one of the keys to effective implementation – with training shown to increase energy code savings by about 39%.

Strong federal incentives could meaningfully increase green construction and energy code adoption and enforcement. This strategy has worked before. Under the American Recovery and Reinvestment Act



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(ARRA), \$3.1 billion in State Energy Program (SEP) grants were tied to the adoption and enforcement of the latest edition of model energy codes—the then 2009 IECC and ASHRAE 90.1-2007 (applicable to commercial buildings). Governors provided letters committing to adoption of the latest edition and to developing and implementing a plan to achieve 90 percent compliance by 2017.

This approach was impactful. As of September 2009, [only two states met or exceeded the 2009 IECC or ASHRAE's 90.1-2007](#) efficiency standard. By January of 2011 approximately 30% of states had adopted codes that met or exceeded ARRA's energy code requirement. To date more than [half of states](#) have continued to adopt more current codes and only two states that adopt statewide codes are on code editions prior to the ARRA targets. Notably, because of ARRA, 6 states that leave aspects of code adoption to local governments, adopted energy codes that are applicable statewide. Nearly half of states have taken advantage of federal funding to evaluate code compliance and offer targeted training based on field study findings.

With significant enough incentives attached to tighter compliance structures, states and communities across the country could be encouraged to (1) update to the latest green construction and energy codes, (2) ensure proper enforcement, and (3) stay up to date with later, and more efficient, green construction and energy code editions.

B. Tie federal grant awards to applicant code adoption and require federal funded projects adhere to the latest model codes

A state/local federal funding applicant's adoption and enforcement of up to date green construction and model energy codes should be a condition for receipt of funds or make the applicant more competitive for funding. Such an approach is consistent with legislation that passed twice last year—the [Bipartisan Budget Act](#) and [Disaster Recovery Reform Act](#)—which increase funding or increase applicant competitiveness for funding based on the applicant's adoption and application of modern model building codes that mitigate against natural hazards. Both SEP and Energy Efficiency and Conservation Block Grants (EECBG) could be avenues through which jurisdictional adoption of updated energy and green construction codes is promoted.

Congress should also insist on adherence to the energy code standards it has previously instituted. Section 413 of the Energy Independence and Security Act of 2007 (EISA) required DOE to promulgate regulations establishing standards for energy efficiency in manufactured housing based on the most recent edition of the IECC by no later than December 19, 2011 "except in cases in which the Secretary finds that the code is not cost-effective, or a more stringent standard would be more cost-effective." DOE has yet to finalize regulations requiring these efficiency improvements. In the more than seven years since that deadline has passed, more than [542,000 manufactured homes](#) have been produced. Several proposals in DOE's 2018 RFI on these efficiency requirements indicate that the Department may be considering exempting most manufactured homes from EISA's efficiency requirements. ICC urges Congress to explore means to ensure these requirements are followed.

Federally funded projects should also require adherence to the latest model energy codes (where these codes exceed local requirements). Green construction codes should also be leveraged. The federal government expends billions annually through grant and loan programs to rehab, construct, or provide



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for the purchase of buildings. Locking efficiency design and green construction features into these investments is particularly important considering many will have 50-75 year lifetimes.

EISA took a step toward this outcome for HUD and USDA by requiring energy codes in their grant and loan programs.¹ Within a year after updates to model energy codes, USDA and HUD are required to adopt them, “unless the Secretaries determine that compliance with such revised code or standard would not result in a significant increase in energy efficiency or would not be technologically feasible or economically justified.” After a year, the new codes apply if the Secretaries “make a determination that the revised codes do not negatively affect the availability or affordability . . .” HUD has adopted through rulemaking the 2009 IECC in its Public Housing Capital Fund and Housing Trust Fund programs.² FHA and USDA backed loans for new construction require adherence to the 2009 IECC.³ HUD/USDA minimum standards should be updated to the latest energy codes which would achieve efficiency savings of at least 25%.

Broader application of current green construction and energy codes throughout the federal government would provide greater efficiency benefits. For example, Community Development Block Grants (CDBG) do not include a minimum building code standard. Since 2017, Congress has awarded roughly \$40 billion in disaster recovery funds through CDBG in addition to the program’s annual \$3 billion outlay.

Requiring adherence to current building codes through federal programs tracks the just released [National Mitigation Investment Strategy \(NMIS\)](#). The NMIS, released by the FEMA-chaired Mitigation Framework Leadership Group (MitFLG), presents a unified national strategy on mitigation investment that reduces risks posed by natural hazards and increases the nation’s resilience to disasters. The MitFLG is composed of 14 federal agencies and departments as well as state, tribal and local officials and is charged with coordinating the strategy’s implementation. One of the most critical recommendations in the strategy is “[u]p-to-date building codes and standard criteria should be required in federal and state grants and programs.”

C. Increase and maintain training, education, and workforce funding

BECP is the development, adoption, and deployment arm of energy codes within DOE. The program provides technical resources to support state and local code adoptions and enforcement, including software tools, training and education, and other technical assistance. The BECP budget (currently \$7 million) is about a third of what it was post ARRA, curtailing technical assistance, training, and education. Consistent and expanded funding, and coordination with SEP, EECBG and other incentive programs would provide greater resources to communities to undertake code adoption and enforcement (including training and certifications for code officials and training for local architects, engineers, and contractors) and provide a more consistent focus on keeping energy codes up-to-date and fully implemented.

¹ 42 U.S.C § 12709.

² [24 CFR § 905.312](#); 80 Fed. Reg. 5200 (Jan. 30, 2015).

³ https://www.hud.gov/program_offices/economic_development/eeegb/standards.



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D. Support beyond code programs

ICC is actively convening members and other interested stakeholders to identify potential guidance that builds off the existing code infrastructure to deliver zero energy buildings and reduce the embodied carbon in buildings. While this effort is in its early stages, DOE and other federal agencies could help accelerate advancement by providing both technical and financial resources.

The IgCC offers an opportunity to capture energy savings, greenhouse gas emissions reductions, and achieve other sustainability goals through the variety of measures it covers. While the IgCC inherently contributes to reduced energy use and greenhouse gas emissions based on its enhanced requirements beyond the current baseline, the exact levels of improvement have not yet been quantified. As states and localities consider the adoption of the IgCC, data on the magnitude of energy savings and greenhouse gas emission reductions will illustrate how adoption and enforcement of the IgCC will contribute to their energy, climate, and other sustainability goals. Ongoing evaluation of potential changes during development and after publication of each edition would allow for continual improvement and potential alignment with sustainability goals. The technical expertise of agencies like DOE and EPA to help the IgCC developers to quantify the level of savings would improve the underlying code and help advance its adoption.

A cooperative grant program for existing codes and standards developers would allow DOE and EPA to provide technical and financial resources to support enhanced or accelerated methods for achieving zero energy buildings and reduced GHG emissions and embodied carbon.

E. Strengthen model energy code incentivization through state certifications under the Energy Policy Act of 1992

BECP, supported by Pacific Northwest National Laboratory, evaluates each new edition of model energy codes to determine energy savings compared to prior versions. This determination triggers a requirement for states to evaluate their current energy code and provide a certification to the DOE Secretary that for commercial buildings they have updated their codes to meet or exceed the updated edition and for residential buildings that they have made a determination as to whether it is appropriate to revise their code to meet or exceed the updated edition.⁴ Current determinations are given based on energy cost, site energy, and source energy. To encourage greater focus on greenhouse gas emissions improvements associated with each edition of the code, future determinations could also include a determination of greenhouse gas emissions improvements across editions.

Additionally, while states are required to make a certification on their response to the new code edition, there is no penalty or incentive based on the certification and the statute expects commercial code updates but not residential updates ("whether they have updated their codes" versus "whether it is appropriate to revise their code"). Tying these determinations to funding incentives and treating residential and commercial the same would strengthen existing state requirements.

⁴ 42 U.S.C. § 6833.



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F. Establish consistent DOE participation in code development

The IECC development process is open to all interested parties and improvements in the code are driven by proposals offered by interested parties, including DOE. DOE participation in the code development process has varied. A policy governing DOE's participation would provide clarity to DOE leadership on the Department's participation and ensure a more consistent level of participation.

G. Coordinate federal research on buildings and increase funding for these activities

Multiple federal agencies support research activities within the buildings industry including NSF, DOE, NIST, FEMA, and EPA. Often, the research priorities of these agencies are not coordinated. U.S. investment in buildings research is also [relatively limited](#) and lacks the focus many other countries have shown.

A coordinated approach to buildings research with a greenhouse gas emissions focus including energy efficiency, embodied carbon, renewable energy, and energy grid integration would be beneficial. Increased funding and greater coordination would foster significant advancement in building technologies and greenhouse gas reduction. These advances ultimately may be captured by future building code editions, ensuring their widespread and lasting integration into the built environment.

The National Earthquake Hazards Reduction Program (NEHRP), where relevant agencies come together around a common goal and share their individual areas of strength, may be a model to support research and actions in this area. Such a program could be highly focused just on energy and greenhouse gas emissions or broader to focus on buildings in general, assuring that energy efficiency is considered alongside natural hazard mitigation and other important building attributes.

ICC recommends increased research funding (tied to pilot and deployment programs) to support the following activities: energy efficiency products (improvement to existing products and new technologies that provide the same or improved performance using less energy); building-grid interactions; systems efficiency; embodied carbon of building products/life-cycle based decision making; optimization of the design, construction, and operations processes to support efficiency; and social science research on building occupant behavior and motivating factors.

Thank you for the opportunity to provide testimony. If you have any questions concerning ICC's comments, please do not hesitate to contact me.

Sincerely,

Gabe Maser
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Subcommittee on Energy
Hearing on
“Building a 100 Percent Clean Economy: Solutions for the U.S. Building Sector”
September 20, 2019

Curtis J. Zimmermann, Ph.D., J.D.
Manager, Government Liaison
BASF Corporation

The Honorable Fred Upton (R-MI):

1. BASF makes many different products, such as insulation, that help to improve building performance. Thank you for pointing out some of these in your written testimony.
 - a. How important is the “payback” period?

RESPONSE:

The “payback” period for energy codes is one way to determine cost-effectiveness of various efficiency measures used in residential and commercial buildings. Because there is no existing requirement to consider a specific type of payback period, there are multiple ways to consider it. Generally, it is used to characterize the value of a particular code or efficiency improvement and can be framed as a period of time (years) or cash flow (money) or even performance (percent improvement) versus earlier editions of codes or performance metrics.

For many years, the U.S. Department of Energy (DOE) did not undertake analysis on payback periods for energy codes, as it is not a requirement in the existing statute (42 U.S. Code § 6836 – *Support for Voluntary Building Codes*). However, due to requests from certain stakeholder groups, the DOE began voluntarily publishing its cost-effectiveness analysis, including its methodology, for calculating payback for energy codes beginning with the 2009 edition of the International Energy Conservation Code (IECC). This analysis covered both the model code and individual state outcomes. Initially, the DOE examined the payback period on the basis of life-cycle cost, but eventually expanded its analysis to include simple payback and cash-flow analysis. The most recent residential analysis can be found on DOE’s website at this address:
<https://www.energycodes.gov/residential-energy-cost-savings-analysis>

Per DOE, the definitions of the various payback periods which DOE analyzes include:

- 1) **Life Cycle Cost (LCC)** - the primary metric used by DOE to determine the cost-effectiveness of the overall code or specific code changes. LCC is the

total consumer cost of owning a home for a single homeowner calculated over a 30-year period. The economic analysis assumes that initial costs are mortgaged, that homeowners take advantage of the mortgage interest deductions, and that long-lived efficiency measures retain a residual value after the 30-year analysis period.

- 2) **Simple Payback** - a measure of cost-effectiveness defined as the number of years required for the sum of the annual return on an investment to equal the original investment. Simple payback does not take into consideration any financing of the initial costs through a mortgage or favored tax treatment of mortgages. In other words, simple payback is the ratio of the incremental cost of construction and the first-year energy cost savings.
- 3) **Cash Flow Analysis** – considers the fact that most homes are financed and includes the financial implications of buying a home constructed to meet the provisions of the current code compared to the provisions of the previous code(s). As mortgages spread the payment for the cost of a house or an apartment over a long period of time, the cash flow analysis clearly depicts the impact of mortgages.

Based on DOE's definitions, the different types of payback periods can render different outcomes in determining cost effectiveness, especially if it is used as the only criterion. In this manner, it is important to realize that homes and buildings, although constructed by builders and developers, are paid for by consumers and tenants. The payback period not only helps to frame costs or cost-effectiveness, but also long-term benefits of energy efficiency. For example, using a simple payback scheme could be detrimental for consumers who live in and operate the home or building long after the initial period. This approach may incentivize using the cheapest upfront cost considerations with the shortest payback, which ultimately may obscure the best value or benefits for consumers and tenants. A more robust view of payback is important for understanding true cost-effectiveness for consumers, who ultimately pay for, and similarly benefit from, the efficiency that will accrue over the decades during which most homes and buildings operationally exist. This approach could potentially save thousands of dollars in retrofit costs for consumers and avoid energy inefficiencies at the outset.

Additionally, the relative lack of consideration or disclosure of energy efficiency for appraisal and home valuations can also affect the payback. Although some builders and real estate professionals provide information about efficiency features in a home, it is not a standard requirement and there is not a specific tool or metric used across the industry that effectively informs consumers about costs and payback. For example, survey data published by the National Association of

Home Builders (NAHB) has shown that homebuyers are willing to pay more upfront for long-term efficiency, but it is challenging for builders to get those considerations built into the existing home valuation and appraisal process in a nationally-consistent manner. If efficiency, performance and operational cost information became a standard disclosure during the homebuying process, consumers could more accurately determine value and affordability and then make more informed decisions about upfront costs and payback.

- b. What other factors, including Federal programs such as building energy codes, contribute to the cost-effectiveness of BASF products?

RESPONSE:

Federal programs that support energy efficiency, sustainability and resilience for homes and buildings can help provide a robust cost-effectiveness framework for residential and commercial construction in the U.S. While building energy codes are one important aspect, cost-effectiveness is not limited to energy efficiency alone. Sustainability, resiliency, and speed of construction are also some important co-benefits beyond saving energy – i.e., comfort, durability, etc. Recognition of these important features of building performance by federal programs, either within DOE or within other federal programs, e.g., Federal Housing Administration, could help provide consumers with additional protection from risk in natural disasters, e.g., hurricanes. Cost-effectiveness considerations should include energy efficiency performance, but also should recognize the important additionalities of sustainability and resilience. In this manner, it is much more cost-effective for consumers to make minor repairs to a home that stayed intact and potentially avoid rebuilding from scratch in major weather events. Any federal incentives to support greater consideration of this type of sustainability and resiliency for homes and buildings could further help protect what is often the largest store of personal wealth for most Americans, i.e., their home.

Regarding building energy codes specifically, BASF's products, like many of our peers and competitors, are evaluated on the basis of energy efficiency performance for compliance with energy codes. BASF's products, like insulation, help achieve both efficiency and comfort in residential and commercial construction. BASF's products also help builders achieve or exceed compliance with the model codes, which are developed through a consensus process that features builders, but also includes other stakeholders. The government recognizes this code development process because it draws on the expertise of the community which is directly affected by the codes. Because it is consensus-based, the process allows for thorough consideration of proposals to improve efficiency that is considerate of both costs and benefits. Importantly, building energy codes do not mandate specific products, but rather are developed in a manner that considers a number of factors contributing to the overall performance of the building envelope. As a material and product supplier to the efficiency value

chain, BASF supports the code development process and other measures to encourage greater efficiency in homes and buildings, which consume nearly 40% of all the energy used in the United States. BASF's products help deliver efficiency and that improves the cost-effectiveness for consumers who must pay for the energy used to heat and cool our nation's homes and buildings.

**Subcommittee on Energy
Hearing on
“Building a 100 Percent Clean Economy: Solutions for the U.S. Building Sector”**

September 20, 2019

**Mr. Arn McIntyre
President
McIntyre Builders, Inc.
On behalf of National Association of Home Builders**

The Honorable Fred Upton (R-MI):

- 1. You stated that “net zero” or near “net zero” building is extremely difficult, costly and impractical in many parts of the nation.**

- 1. Could you provide an estimate of the added cost to the average consumer?**

The balance of systems and the cost of associated measures required to achieve a near net-zero or net-zero energy performance continues to be a source of debate and a subject of continued evaluation. The answer will vary dramatically depending upon the geographic location, specific climatic conditions, building system type, financing options, customer preferences, available fuel sources, local development policies and incentives, and other project-specific factors.

It is important to recognize that achieving net or near net-zero has two primary areas of a building system to consider. First is the structure itself and the energy load or efficiency of the structure. The second is the addition of site energy generation capability. It must be realized that there are no building systems currently available that will allow a building on its own to achieve net-zero. While building methods have improved dramatically over the last couple of decades the building itself is still an energy load. At some point and I feel we are at or near that point we will reach a diminishing cost return with current building technology. That brings forth the second building system, site generation. Today for a building to reach the net or near-net it must be coupled with a site generation or community generation system. This includes a multitude of options such as solar, wind, hydro, micro-hydro, etc. We need to recognize that any of these systems are a significant extra cost to the homeowner and in the eyes of most consumers are not necessary for them to have a livable home.

Depending on the baseline starting point to achieve a near net-zero or net-zero home, you can expect the following costs to impact the price for the consumer:

- The added cost of an onsite generation system
- The added cost of the building envelope
- The added cost of the mechanical systems
- The added cost of continued upkeep and management of the more sophisticated building systems and controls

With respect to cost as I stated above, the site generation system in its entirety is an added consumer cost. Depending on the method of generation and the system size, this can range greatly with \$20,000 to \$50,000 plus to be expected. As I mentioned in my previous testimony, my solar panel system installed in July 2019 was near \$20,000 which included materials only with all installation labor being performed by myself. To add installation cost would double that figure. This is a cost above and beyond the building cost.

As a complete building system site generation combined with building improvements for a typical 2,500-square-foot single-family house, an expected price premium to achieve a net-zero performance will range between \$30,000 and \$60,000 or more depending on the factors described above. Returns on these investments will take significantly longer and, in some cases, incentives will be needed to achieve payback within the expected life of the equipment.

Finally, there will be added costs for maintaining the efficiency and functionality of the more sophisticated equipment and mechanical systems. For example, a range of reported operation and maintenance costs for a 10kW solar PV system is \$130-\$300 per year.

2. Could you explain why it is impractical in certain parts of the nation, such as Michigan, for example?

Michigan is a classic example of why it is impractical to mandate "net-zero" or "near net-zero" energy homes. The heating load throughout the state (especially in the UP) is extremely high; even with highly insulated walls and ceilings, high-performance windows, and the highest efficiency heating/cooling equipment. That means there will still be a large amount of energy needed to heat/cool and operate the house over the year. To achieve net-zero or near net-zero with Michigan's high heating demands and low solar resources, a high number of solar panels will be necessary which could easily exceed the roof area with southern exposure. Just the solar panels needed to meet the total energy demand for a house would add over \$40,000 to the price of the house.

To achieve the levels of performance implied by the net-zero target, builders would need to significantly change their construction practices and turn to solutions that are not cost-effective to the consumer, not readily applicable within the constraints of the residential building sector, not supported by the current building industry infrastructure, and unwelcome by the home buyer. Imposing a net-zero mandate would be onerous and harmful to the building industry, but more importantly, it would negatively impact housing affordability for the consumer and stifle the supply of new homes – all with only a marginal contribution to the goal of reducing emissions from fossil fuel combustion by the US economy.

There is not a one-size-fits-all solution to attaining reductions in emissions in a way that strikes a balance between making a meaningful impact on emissions, maintaining a vibrant economy, and meeting consumer expectations and the ability for home affordability. Net-zero homes is not the answer for Michigan conditions defined by low winter temperatures and one of the lowest solar resource in the continental United States.

2. I would rather allow consumers to pick the winners and losers among competing technologies and high-performance building designs, rather than the Federal government.

a. What are some consumer-focused or market-driven policies that we could consider in contrast to a Federal mandate?

Rather than focus on near net-zero homes with their rooftop solar systems, the focus should be on improvements to utility-scale generation. Utility-scale generation using renewable sources of energy can already be cost-effective when compared to adding further efficiency measures to the construction of new homes. According to NREL, utility generation using solar energy is about 1/3 of the price per kW delivered to the site compared to rooftop solar PV generation.

The concept of a net-zero building is not the most cost-effective strategy for achieving meaningful reductions in emissions from burning fossil fuels. New homes represent only a small fraction of the overall energy use by the building sector (homes built since the year 2000 account for about 3.7% of total U.S. energy use) and homes built annually are adding about 0.2% percent to the total. A more significant effort should be developed for improving the energy performance of the existing housing stock through consumer incentives and improved valuation and financing mechanisms that would be attractive to the homeowner.

As with any product introduction to the market, consumer acceptance and adoption are key to product scaling. There are many examples over the decades of products scaling beyond expectations. One of the later examples is the smartphone and an emerging example would be electric automobiles. Neither of these products involved mandates. There are many more examples but the key point is that any product that disrupts and reshapes an industry has delivered significant consumer value. Value to the point that the consumer makes the active decision based on the received benefit to adopting the product. There are few if any examples that mass-market adoption of a product was achieved through mandates. Mandates in themselves will only deliver what is mandated and nothing more because the consumer is not driving the decision and is only buying "what they have to". Mandates will likely deliver less of an impact because they are mandating the wrong thing. This is very likely the case that would occur with net-zero homes. The American homeowner is a very intelligent consumer and, when presented with a value-driven buying opportunity, they will make the right decision and most often go beyond our expectations.

To achieve this, our lawmakers need to understand the policies that impact the ability of the industry to deliver value in high-performance homes. Policies that impact cost and performance. Rather than look at the specific measures to construct a net-zero energy home look at the business case to deliver it. Focus on regulation reduction, tax policy, incentive programs, technology development, zoning impact, utility buy-back, appraisal metrics, etc. Develop a policy that is regular and consistent over time. Policy that the industry can count on which allows us to develop and deliver an affordable, cost-effective, high-value product to the American homeowner.